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Founded 1871

Volume 111 1999

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A Journal of Scottish Natural History

THE SCOTTISH NATURALIST

Founded 1871

A Journal of Scottish Natural History

Editorial Committee:

J.A. Gibson

John Hamilton

John C. Smyth

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The *Scottish Naturalist,* now published by the Scottish Natural History Library, is an independent journal primarily devoted to the study of Scottish natural history. It was founded in 1871 by Dr. F. Buchanan White, of Perthshire, and in 1988 completed one hundred years of publication. For a summary of the record of publication, see the inside back cover.

Although the journal's main interests have always centred on the history and distribution of Scottish fauna and flora, it is prepared to publish contributions on the many aspects of Scottish natural science embraced by its title, including Zoology, Botany, Geology, History, Geography, Medicine and the allied sciences, Archaeology, and the Environment.

All papers and notes for publication, or books for review, should be sent to the Editors at the Scottish Natural History Library, Foremount House, Kilbarchan, Renfrewshire PA10 2EZ.

Contributions should be clearly written; whenever possible they should be typed, double-spaced, on one side of the paper, with adequate margins, and should try to conform to the general style and arrangement of papers and notes in the current number of the journal. Maps, diagrams and graphs should be drawn in black ink on white unlined paper. Photographs should be on glossy paper. Proofs of all contributions will be sent to authors and should be returned without delay.

Authors of papers, but not of short notes, will receive thirty reprints in covers free of charge. Additional reprints may be ordered, at cost, when the proofs are returned.

The *Scottish Naturalist* is usually published three times a year. The standard annual subscription is £35.00, which should be sent to the Editors at the Library address. Members of recognised natural history organisations, however, can receive the *Scottish Naturalist* at a greatly reduced subscription; for details apply to the Editors.

THE SCOTTISH NATURALIST

Volume 111

1999

THE SCOTTISH NATURALIST

Founded 1871

A Journal of Scottish Natural History

With which is incorporated *The Annals of Scottish Natural History*
and *The Western Naturalist*

111th Year 1999

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NATURAL HISTORY AND THE SEA

A Conference of
THE SOCIETY FOR THE HISTORY
OF NATURAL HISTORY

Discovery Point
Dundee

26th-27th September 1997

General Editor

Dr. J.A. Gibson
Scottish Natural History Library

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Editorial Note

Many of the illustrations in this volume are based on items which are well over a hundred years old, and which in the early years of their existence were often stored in unfavourable conditions, so that even with the latest computer technology it has not always been entirely possible to rectify all the damage or deterioration which has occurred over the years.

FOREWORD

By W.D. IAN ROLFE
President 1996-99,
Society for the History of Natural History

The papers contained in this volume of the *Scottish Naturalist* were presented and discussed at a two-day conference of the Society for the History of Natural History on *Natural History and the Sea*, held at Discovery Point, Dundee, on 26th and 27th September 1997. The conference was extremely well attended, with delegates from all over the country, and as Jane Pickering, then Meetings Secretary of the Society, reported (*S.H.N.H. Newsletter*, 60: 2): "The meeting was in the best tradition of the Society: a gathering of experts, enthusiasts and interested observers. The site of the meeting, a purpose-built room with *R.R.S. Discovery* moored outside the window, was perfect."

As was appropriate in the 75th anniversary year of the death of Shackleton, the programme had a strong polar theme, which the fine series of papers presented at the conference, and published here in the *Scottish Naturalist*, reflect. A tour of *R.R.S. Discovery,* built in Dundee during 1900-01 for the National Antarctic Expedition of 1901 - 1904, was one of several high points of the meeting. Another was a visit to the exhibits in the award-winning Discovery Point, which vividly recreate the building, launch and scientific explorations of *Discovery*.

The meeting was ably organised by Mr. Michael A. Taylor, former Council Member of the Society and Head of Arts and Heritage at Perth Museum and Art Gallery, in which task he was supported by Dundee Heritage Trust. Guidance in compiling the programme came from staff of the British Antarctic Survey and of the Scott Polar Research Institute. Dr. J.A. Gibson, the Society's Representative for Scotland, thoughtfully arranged for the publication of the conference papers in the national journal of Scottish natural history, the *Scottish Naturalist*. Refreshments were sponsored by Watson & Philip plc of Dundee. The Society thanks all these for helping to make the conference such a memorable occasion.

The Society for the History of Natural History organises about five meetings each year, ranging from evening meetings to biennial international conferences. It is known for its friendliness, and meetings aim to combine intellectual excellence with opportunities for the informal exchange of ideas. Based at The Natural History Museum, London, the Society is the only international society for those

interested in the history of botany, geology and zoology; it has several international branches. *Archives of Natural History* is the respected journal of the Society which, together with a regular *Newsletter*, is distributed free to members. Details of Society membership are available from the Secretary, Society for the History of Natural History, The Natural History Museum, London SW7 5BD.

Dr. W.D. Ian Rolfe,
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THE NATURAL HISTORY OF ANTARCTICA: THE EARLY VOYAGES

By R.K. HEADLAND
Scott Polar Research Institute,
University of Cambridge

Introduction

In this paper, on the geography and history of the Antarctic, with the theme of the history of natural history, it is proposed to provide an account of what has happened, from ancient times to the heroic age which began about a century ago (see Table 1). Subsequent papers at the conference will then take the account further.

Geography

The geography of Antarctica is generally known, but let me indicate some of the distinctive features. First one should recall just how dissimilar the two polar regions are: the Antarctic is a frozen continent surrounded by ocean, and the Arctic is a frozen ocean surrounded by continents. The basic facts for both regions are compared in Table 2.

Recalling the theme 'Natural History and the Sea' one should consider marine circumstances where the polar conditions are reasonably analogous in the Arctic Ocean and Southern Ocean, with their associated seas. Conditions below the surface are often much more comfortable for organisms than on the surface. Salt water freezes at -1.8°C, and the sea can never go below this despite very much lower air temperatures; at low temperatures the water becomes insulated by snow and pack ice on its frozen surface. Nevertheless it is decidedly cold water, although well mineralised (from glacial run-off and upwellings near some islands), well oxygenated where exposed (action of turbulent weather; and oxygen dissolves far better in cold than in warm water), and has much illumination during summer months. These conditions allow specialised marine life to become abundant - especially compared with that found on the land.

Exploration

I have found it practical and convenient to divide Antarctic history into several stages during the progression of the exploration; these are indicated in Table 1.

Table 1

Stages of Exploration and other Activity in the Antarctic

Terra Australis	until 1780
Sealing Period	1780-1892
Continental Penetration	1893-1918
Whaling Period	1919-1943
Permanent Stations	1944-1958
Treaty Period	1959 onwards

This paper deals with the first three of the above stages, up to the commencement of the Heroic Age of continental exploration, which began about a century ago.

The names suggested indicate only the dominant theme of each stage, in which there were always other exploratory activities. Similarly the dates are generalisations - there are no 'watertight compartments' in the historical continuum.

TERRA AUSTRALIS

This earliest period lasted until approximately 1780. Its beginnings were ancient and entirely theoretical, when many geographers hypothesised that a large land mass 'Terra Australis' covered the southern parts of the Earth. This was deemed necessary to be a counter-balance to the partly known Arctic land masses and thus to maintain the stability of the spherical Earth.

About 43 A.D. the Roman philosopher Pomponius Mela hypothesised that this theoretical continent had a human population, and he proposed the name 'Antichthones' for the supposed inhabitants.

Conjectural maps of Antarctic regions were produced by several publishers during the later years of this period. Some concession to the natural history of the unknown regions was made by the addition to the charts of various splendid sea monsters.

While several expeditions went in search of this hypothetical continent, most of the exploration during the first stage was by voyages to other southern regions, which found only more and more ocean and thus progressively, although quite by chance, reduced the size of 'Terra Australis'. After the voyage of Abel Janszoon Tasman in 1644, cartographers separated Australia and New Zealand from the yet unknown Antarctica, which was thence even more reduced in size.

An interesting early reference, during this period, was to one of the best known Southern Ocean groups of birds, the albatrosses. In 1674 Friderici Lachmund of Amsterdam produced a booklet *De Ave Diomedea Dissertatio*. This extremely rare 48-page work of natural history (its title page and principal illustration are reproduced in Plates 1 and 2) discussed the group. I mention albatrosses, rather than penguins, as a notable southern species because penguins are found in all the southern continents and one species extends as far north as the equator.

This Terra Australis period may be regarded as being brought to a conclusion with the three voyages of James Cook and the two of Yves-Joseph de Kerguelen-Trémarec.

DE
AVE DIOMEDEA
DISSERTATIO,

Cum Verâ ejus effigie æri inciſa,

ex Muſéo

D. FRIDERICI LACHMUND

HILDESHEIM.

Ad Cl. Virum,

Dn. D. JOHAN. DANIELEM

MAJOREM,

In Acad. Kilon. Anatom. &
Botan. Prof. P. & Ordin.

Rever. & Seren. Epiſc. Lubec. Archiatrum,
nec non Collegii naturæ Curioſorum
Adjunctum.

AMSTELODAMI,

Apud ANDREAM FRISIUM, 1674.

Plate 1

De Ave Diomedea Dissertatio
Title-Page

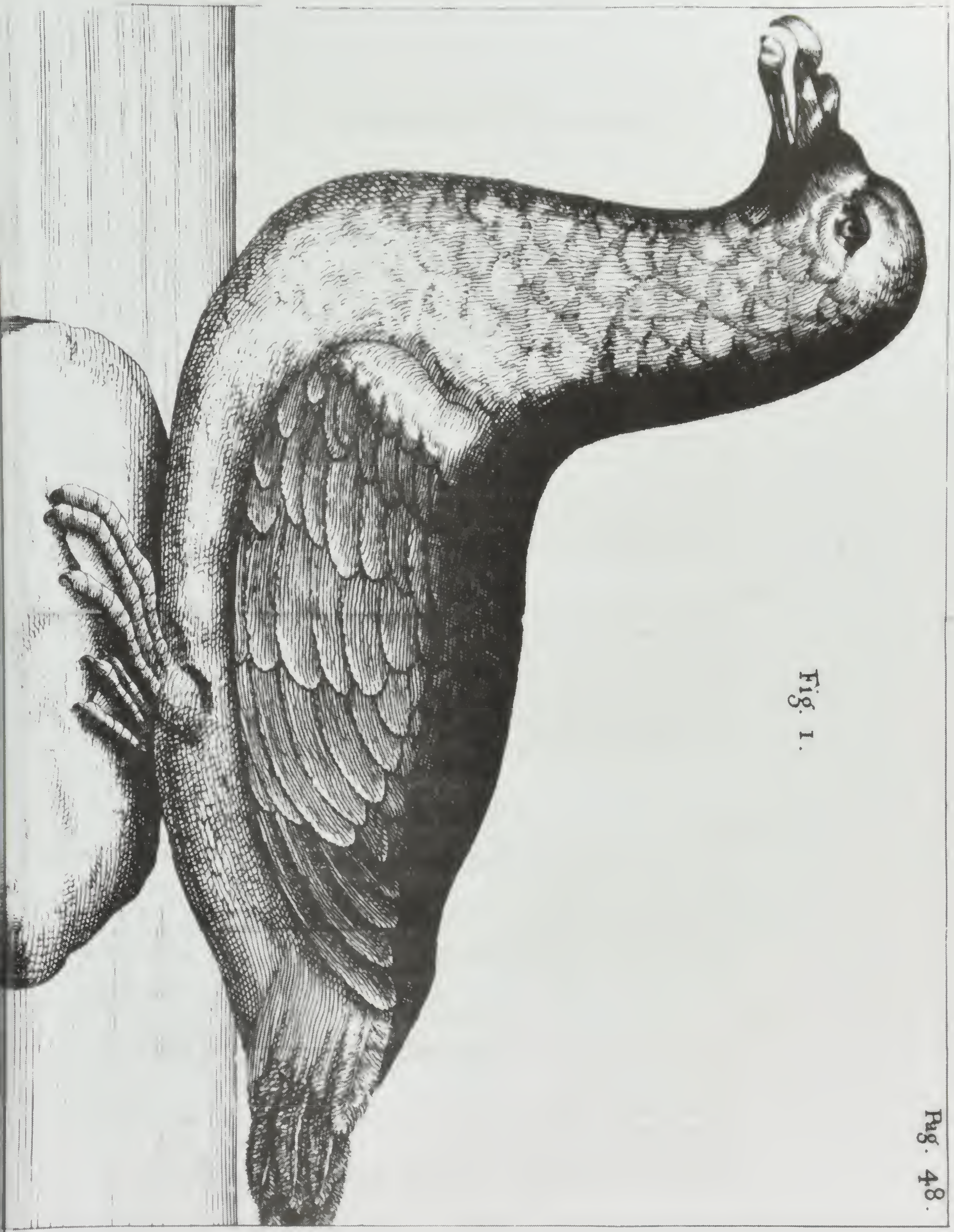


Plate 2

De Ave Diomedea Dissertatio
Illustration of Albatross

Table 2

Polar Comparisons

General

Antarctic:

Confined continent and unconfined ocean with the peri-Antarctic islands
Distinct boundary formed by the Antarctic Convergence
Quite inaccessible; the most isolated continent (900 km distant from any other)
Altitude of the South Pole: 2,835 m
Thickness of ice at the pole: about 2,757 m
Antarctic land surface area 13.9 x 10^6 km^2
99.6% covered by permanent continental ice

Arctic:

Confined ocean and unconfined continents with Greenland and several archipelagos
The boundaries are not distinct
Comparatively accessible; closely connected with other land masses
Ocean depth at North Pole: 4,179 m
Thickness of ice at the pole: about 1.8 m
Arctic Ocean surface area 14.5 x 10^6 km^2
50% covered permanently by sea ice

Ice Cover

Antarctic:

Antarctica; the others, on the peri-Antarctic islands, are comparatively insignificant
Area 13.7 x 10^6 km^2
Volume: 24 x 10^6 km^3
Greatest depth: 4,776 m
Average depth: 2,160 m
Deepest bedrock depression: 2,538 m
90% of the ice on Earth

Arctic:

Arctic; Greenland; those on other islands are comparatively insignificant
Area: 1.8 x 10^6 km^2
Volume: 2.5 x 10^6 km^3
Greatest depth: 3,350 m
Average depth: 1,200 m
Deepest bedrock depression: 450 m
9% of the ice on Earth [90 + 9 = 99%; Earth is 11% ice covered]

Altitudes

Antarctic:
- 4,897 m Vinson Massif
- South Pole: 2,835 m above sea level,
  - on an ice sheet the surface of which flows about 10 m annually

Arctic:
- 3,693 m Gunnbjørns Fjæld, Greenland
- North Pole: about 1.0 m above sea level,
  - on sea ice which drifts up to 20 km daily

Oceans

Southern Ocean:
- Sea ice extent
  - Maximum (winter) area: 20 x 10^6 km^2 (60% of the ocean)
  - Mimimum (summer) area: 2 to 4 x 10^6 km^2 (2-3% of the ocean)
  - Mean thickness: 1.7 m
- Average duration of a floe: 1 year
- Maximum bathymetry > 6,000 m
- Small annual influx of water, from glaciers

Arctic Ocean:
- Sea ice extent
  - Maximum (winter) area: 12 x 10^6 km^2 (85% of the ocean)
  - Minimum (summer) area: 6 to 9 x 10^6 km^2 (50% of the ocean)
- Mean thickness: 3.0 m
- Average duration of a floe: 2-3 years
- Greatest depth 5,200 m
- Very large annual influx of water, from rivers

Natural History

All organisms have adapted to an exceptionally severe environment. Minima of -89.2° C in the south and -68° C in the north are recorded. Geology includes virtually all formations. Geomorphology is predominantly glacial.

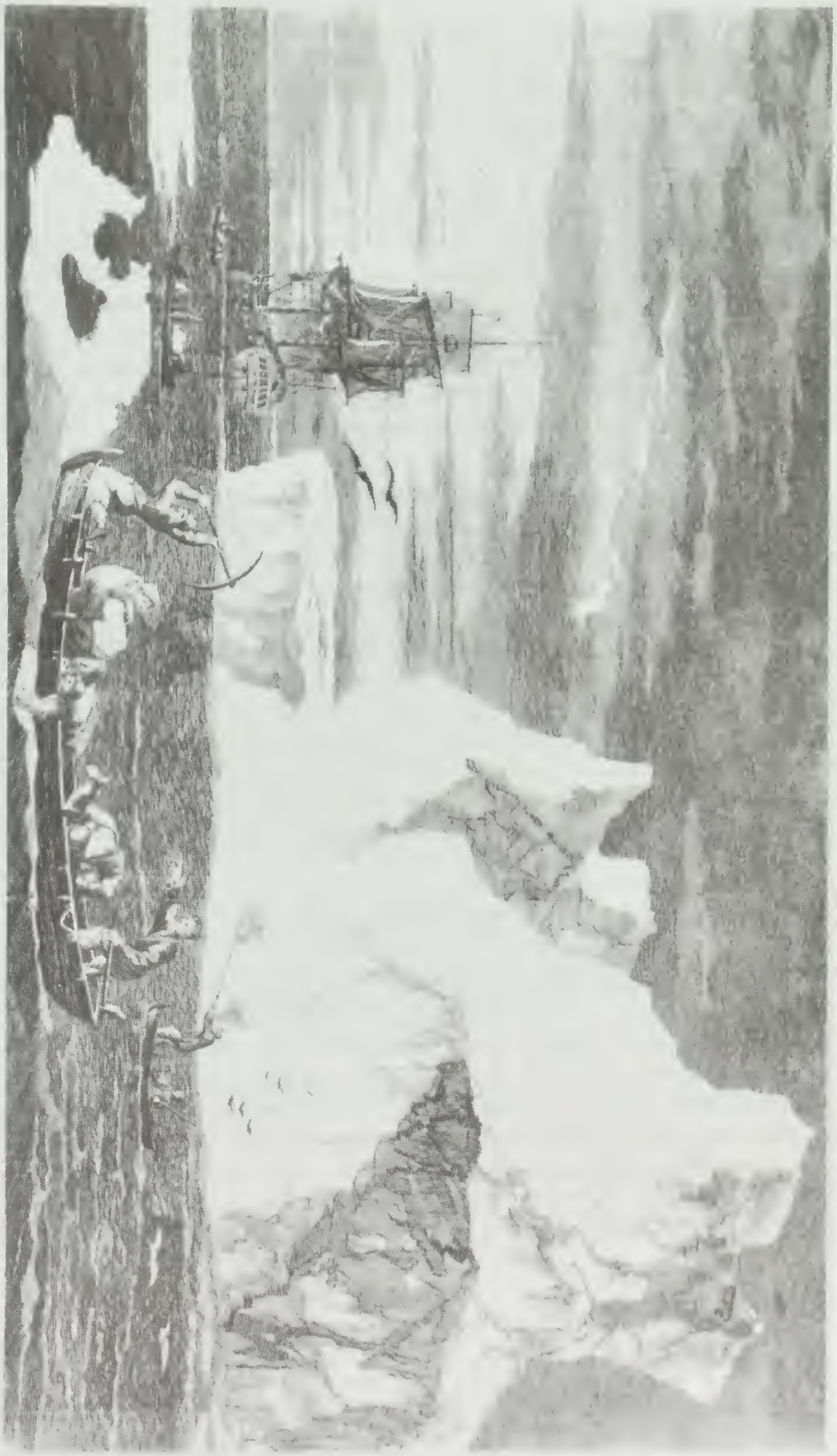
Antarctic:
- Flora and fauna are highly endemic because of the extreme isolation
- No indigenous human population
- [Typifying species are the penguins]

Arctic:
- Flora and fauna are closely related to European, Asian, and
  - North American species
- Indigenous human populations (Eskimo, Lapp, Chukchi, Samoydeds, etc)
- [Typifying species is the Polar Bear]

Plate 3

A Method of Collecting Natural History Specimens during Captain Cook's Expedition

(Illustration from Cook, 1777)



Of these captains, Kerguelen ended up in serious trouble because of fabulous claims for the islands he discovered. His putative contribution to natural history was largely by exaggerating the resources of a small, fairly barren, island. This so displeased the King of France that Kerguelen spent six years in prison. Cook was by far the more significant, especially because of the results of his second voyage (from 1772 to 1775) which had specific instructions to discover the 'Great Southern Continent'. During this voyage he made the first circumnavigation of the Earth in high southern latitudes. Cook's vessels, H.M.S. *Resolution* and H.M.S. *Adventure* (commanded by Tobias Furneaux), crossed the Antarctic Circle for the first time on 17th January 1773 and reached a new farthest south (71.17°S. at 106.90°W.) on 30th January 1774. On 17th January 1775 he landed on South Georgia and took possession for King George III, the earliest territorial claim in the Antarctic. At the end of Cook's voyages the idea of a southern continent extending to temperate latitudes was finally dispelled.

Cook's instructions enjoined him, if he found the continent, to explore it and make such "observations of every kind as might be useful either to navigation or commerce, or tend to the promotion of natural knowledge" (see Plate 3). Unfortunately Joseph Banks, who accompanied Cook's first voyage (1768-71), was unable to accompany the second and the choice of naturalists was not fortunate. Johann Forster and his son made many observations and collections, but caused an abnormal amount of altercation and controversy. The other scientific staff, all called William, were astronomers (Wales and Bayley) and an artist (Hodges). The views and observations they made allow the course to be plotted with quite unprecedented accuracy. The best account of Captain Cook's voyages, and indeed his biography, is undoubtedly that by John Beaglehole (1961) which contains detailed bibliographies of the natural history collections made during the voyages.

SEALING PERIOD

As well as the charts produced, Captain Cook's voyages led to the next stage for two more reasons: First, from the observations of the natural history, he reported abundant Fur Seals on South Georgia and other Antarctic islands; second, his reports on commerce indicated that a very lucrative market for fur seal pelts existed in China. The early 'Sealing Period' in Antarctic history developed directly from this, and was dominant between approximately 1780 and 1892, although the last sailing vessel did not return to port until 1922. During this period the majority of visitors to Antarctic regions were sealers, who discovered many and visited nearly all the peri-Antarctic islands. Most sealers were from Britain and the United

States of America (New England states), although others operated from Australia, Cape Colony, France, Germany, and New Zealand. Sealers made the first landings on Antarctica (1821) and were the earliest to winter in Antarctic regions, notably those who did so involuntarily on the South Shetland Islands in 1821 and 1877 (Headland, 1989).

It is this period which will be specifically described, in approximately chronological order. Expeditions which made contributions to the knowledge of the Antarctic natural history were sporadic and rather diverse during the course of this early period, but laid much of the foundation for the work of the intense scientific period which followed. With sealers there are many problems in determining exactly where they worked, because secrecy was part of the capital of this highly competitive industry. Thus, with a few notable exceptions, sealers made little contribution to knowledge in general, and their maps were exceptionally scarce.

There is also the problem of summarising several major voyages; some detailed papers could be presented, but in the available space it will be possible to afford each only a condensed mention.

Bellingshausen

Of the few exploratory voyages during this period, some did make important discoveries. The earliest of these was Russian, led by Fabian Bellingshausen, aboard *Vostok*, accompanied by *Mirnyy* (Debenham, 1945). His voyage had many analogies to that of Captain Cook, and completed the second circumnavigation of the Antarctic continent in high southern latitudes, during which he sighted, but did not recognize as land, two areas on the Kronprinsesse Märtha Kyst and Prinsesse Ragnhild Kyst. This was the first sighting of the continent, made on 27th January 1820; the ice shelf, at about 69.35°S. and 02.23°W., was surveyed. This was also the first evidence of land detected south of the Antarctic Circle. Unfortunately, despite several attempts, Bellingshausen had been unable to recruit a specialist in natural history to join the expedition.

Weddell

James Weddell (of the sea and the seal) was one of the rare exceptional sealers who recorded his observations and explorations (Weddell, 1825). Some of the best of the early Antarctic charts are his work. During his three Antarctic voyages, in 1819-20, 1821-22 and 1822-24, which reached the South Shetland Islands, South Orkney Islands, South Georgia, and the vicinity, he made many observations

and collected specimens. When surveying a position at the western end of South Georgia, he reported that the mercury of his artifical horizon was in such a constant and tremulous motion that observations became quite impossible. He concluded that a volcanic phenomenon was responsible, and while, for geological reasons, this was not so, it also shows that he carried such an instrument - and was about the only sealer to do so. The first Weddell Seal was collected by him and prepared for the Royal College of Surgeons in Edinburgh; unfortunately the method of stuffing enormously distorted the animal (see Plate 4).

Morrell

In contrast one might consider another sealer, Benjamin Morrell, whose published work includes many supposed natural history notes (Morrell, 1832). He reported new lands, later determined to be non-existent, and describes finding, near the South Sandwich Islands:

> "...a number of very curious birds, about the size of a pigeon, with a green head. The back of this bird was a grey black, and the breast was variegated with all the colours of the rainbow. The tail, which was long and bushy, was of a hue approaching to yellow, and resembling the bird of paradise".

As regards natural history observations, however, one should add that Benjamin Morrell had a reputation of being "the biggest liar in the Pacific" (Gould, 1929).

Weddell and Morrell probably provide the greatest contrast in observers of natural history among the sealers; unfortunately most of the others said nothing, but they must have come to know a lot.

Foster

A Royal Navy expedition, commanded by Henry Foster aboard H.M.S. *Chanticleer*, made the earliest geophysical measurements in the Antarctic (Webster, 1834). It reached the South Shetland Islands during the austral summer of 1828-29 to make pendulum and magnetic observations on Deception Island, which was charted (Plate 5). The volcanic phenomena were also investigated. Maximum and minimum thermometers were left at Port Foster when the expedition departed. These were collected by one of the enterprising sealers, William Horton Smyley, in 1842; unfortunately he did not know how Fuess thermometers registered; thus he lost the maximum temperature. The minimum was recorded and, for the rest of the century, was regarded as the Antarctic minimum; it read -5.0°F. (-20.3°C.). Smyley also reported much volcanic activity on the island (Bertrand, 1971)

Plate 4: The Weddell Seal (Illustration from Weddell, 1825)

Plate 5: Pendulum Cove, Deception Island (Illustration from Webster, 1834)

Pendleton

In 1829-31 a United States government scientific party took advantage of a sealing voyage and joined one from New England. This sailed from New York and Stonington, with Benjamin Pendleton as senior commander aboard *Seraph* accompanied by *Annawan* and *Penguin*. The vessels visited the South Shetland Islands, from January to February 1830. The scientists (James Eights, Jeremiah N. Reynolds, and John Frampton Watson) made biological and geological investigations and collections which included the earliest fossils from the Antarctic (Bertrand, 1971).

France, U.S.A. and Britain

These few natural history contributions were eclipsed, by a quite coincidental and major burst of activity between 1837 and 1843, when three expeditions, somewhat in competition, were in the Southern Ocean. They were dispatched by the governments of France, the United States, and Britain. A major object of the voyages was to determine the position of the South Magnetic Pole for navigational purposes; additionally each made general surveys of parts of Antarctica and several surrounding islands. Each completed a circumnavigation. These expeditions competed for discoveries, but the combined effect of their surveys and comprehensive scientific investigations produced an enormous increase in knowledge of Antarctic natural history. A brief description of each follows.

France

The first to depart was a French naval expedition from Toulon, led by Jules-Sébastien-César Dumont-d'Urville aboard *Astrolabe* accompanied by *Zélée*. They visited the South Orkney Islands, South Shetland Islands, north-west coast of Trinity Peninsula, Orléans Channel, and Joinville Island. Terre Adélie was discovered and possession taken for France on 22nd January 1840; this was the basis of modern French Antarctic claims (see Plate 6). Dumont-d'Urville independently discovered 'Côte Clarie' on 31st January 1840, a few hours later than Charles Wilkes. He collected an egg of an Emperor Penguin (the Drayton egg) on pack ice, but it was not until the early 1900s that the relationship between the species of bird and the egg was determined.

Natural history was not entirely the highest priority, as shown by the comment after landing at Ile du Debarquement. The account reads:

> "We immediately lept ashore armed with picks and hammers. ...I straight away sent one of our sailors to plant the tricolour on this land that no human being before us had either seen or set foot on. Following the ancient and lovingly preserved English custom, we took possession of it in the name of France, as well as the adjacent coast where the ice had prevented a landing. Our enthusiasms and joy were boundless then because we felt we had just added a province to France by this peaceful conquest. ...
>
> The ceremony ended, as is mandatory, with a libation. To the glory of France ... we emptied a bottle of the most generous of her wines that one of our companions had the good sense to bring along with him. ... The generous liquor reacted to our advantage against the harshness of this temperature. All this took less time than it takes to write about it. Then we all set to work to collect everything of interest for natural history that this inhospitable land had to offer".

The only animals were Adélie Penguins, dispossessed from the rocky island. Seaweed and minerals were also collected (Rosenman, 1987).

U.S.A.

The second of these voyages was the United States Exploring Expedition of 1838-42, led by Charles Wilkes aboard *Vincennes* accompanied by *Peacock, Porpoise, Sea Gull* and *Relief* (which returned early). The voyage sailed with seven scientists and two artists to conduct an extremely broad scientific programme. Off Tierra del Fuego, in February 1839, the fleet divided: one group (*Vincennes* and *Porpoise*) went south and east to the South Shetland Islands (and reported Bridgeman Island as volcanically active); the other (*Peacock* and *Sea Gull*) sailed south-west to a point off Thurston Peninsula, without sighting land. Following work in the Pacific Ocean, the vessels returned to the Antarctic during December 1839, sailing west along the coast of Wilkes Land, discovering and charting a series of land-falls and 'appearances of land' between longitudes 160°E. and 98°E. (*Astrolabe* and *Zélée* were sighted on 30th January 1840, but no contact was made). Macquarie Island was visited; *Porpoise* also visited the Auckland Islands and searched for non-existent Emerald Island. The published charts of the expedition were the first to use the term 'Antarctic Continent'.

The United States collections were not fully described, because of chronic financial difficulties. As far as the marine collections were concerned, there was a series of disasters,. Two volumes of ichthyology, by Louis Agassiz, were proposed but were among those which were never printed (Haskell, 1942) Over 1,000 pages of text and hundreds of illustrations had been prepared for them which, despite surviving immersion in a river after a train crash, were prevented

Plate 6: The Landing of Dumont-d'Urville (Illustration from Dumont-d'Urville, 1846)

from publication for financial reasons by an Act of the United States Senate. The Antarctic collections were later lost, but some subsequent use has been made of the other material (Rofen and DeWitt, 1961).

BRITAIN

The third of this concentrated stage was a British naval expedition (1839-43) led by James Clark Ross aboard H.M.S. *Erebus* accompanied by H.M.S. *Terror*. These were the first vessels to force a way through the pack ice of the Ross Sea. They discovered and roughly charted 900 km of new coast in Victoria Land, which was claimed for Queen Victoria on Possession Island on 12th January and Franklin Island on 27th January 1841, the basis of modern New Zealand Antarctic territories. During the next austral summer, Ross Island and Ross Ice Shelf were discovered and a new farthest south of 78.17°S. was reached on 23rd February 1842. The region around Joinville Island, James Ross Island, Cockburn Island, and the South Shetland Islands was visited. Landings were also made on several peri-Antarctic islands: the Prince Edward Islands, Iles Crozet (sealers and several introduced species reported), Iles Kerguelen (where a magnetic observatory was established at Port-Christmas, natural history collections were made, and coal deposits reported), Auckland Islands (found records of visits by Jules-Sébastien-César Dumont-d'Urville and Charles Wilkes; reported pigs and cats present, and introduced sheep, goats, more pigs, rabbits, and poultry), and Campbell Island. The Balleny Islands were sighted. Joseph Dalton Hooker and Robert McCormick made comprehensive natural history collections, and drift bottles were cast overboard (one dropped in Drake Passage was recovered in Bass Strait).

The British expedition's marine material fared a little better than that of the United States, although John Richardson, in an introduction to the section, wrote:

> "The specimens thus obtained filled many casks, and numerous jars and bottles, and it were greatly to be wished that so much industry had met with the full measure of success that it deserved; but we have to regret that, during a voyage protracted for upwards of four years and a half, including every possible change of climate, and during which the ships were buffeted by many severe gales, and sustained innumerable shocks in forcing their way through ice-packs of the Antarctic Seas, the specimens suffered very severe damage. Owing to the deterioration of the spirits in jars that were crowded with fish, and the long continued action of the brine, where that liquid was employed, very many specimens entirely perished, or merely fragments of skeletons could be rescued from the mass" (Richardson, 1844)

Nevertheless much useful material was reported; especially the excellent sketches drawn by Joseph Dalton Hooker which included nine *Notothenia* species (John Richardson established the genus) a *Chaenichthys*, and two *Harpagifer* from among those taken in Antarctic waters. Some specimens were extracted from the stomachs of seals, and one account gives an early insight into one of the special perils of ichthyology:

> "A remarkable circumstance occurred on board the Terror. ...While her people were engaged chopping away a thick coat of ice from her bows, ... a small fish was found in the mass. .... It was carefully removed for the purpose of preservation, a sketch of it made, and its dimensions taken by Dr. Robertson, but it was unfortunately seized upon and devoured by a cat. ... We have introduced a copy of the design, merely to preserve a memorial of what appears to be a novel form, discovered under such peculiar circumstances" (Ross, 1847).

Thus was the fate of the first known example of Antarctica's most celebrated and unique group of fish - the Ice Fish.

Ross Sea

The Ross Sea discoveries, including the volcanoes Erebus and Terror, were the effective opening of a region to exploration. It became a major site during the subsequent heroic age and remains the second major access to Antarctica. There was rather a conflict between the masters of the United States and the British expeditions; Wilkes charted a coast and named inland features north and west of Cape Adare, but a year later Ross sailed through most of Wilkes' discoveries. Wilkes had apparently confused the edge of the pack ice with land.

Flora Antarctica

Another consequence was the preparation of the handsomely illustrated *Flora Antarctica* between 1844 and 1847 by Joseph Dalton Hooker. The concept of Antarctica was used much more broadly than is now current; nevertheless this *Flora* included descriptions of the plants of the Auckland Islands, Campbell Island, Macquarie Island, South Georgia, Iles Kerguelen, Deception Island and Cockburn Island (South Shetland Islands), as well as many other southern regions.

H.M.S. *Challenger*

The next significant explorations of the far south did not occur until about 30 years later, although several geographical discoveries, including continental

sightings, were made by sealers. These investigations were, to a large extent, initiated as a result of the first successful North Atlantic telegraph cable in 1866. Because of this, interest in the abyssal depths became intense; thus a great increase in bathymetric measurements and in oceanography occurred. The voyage of H.M.S. *Challenger* was a direct result.

This British naval voyage from 1872 to 1876, led by Sir Charles Wyville Thomson, operated throughout all oceans except the Arctic Ocean. Thus H.M.S. *Challenger* circumnavigated the Earth and made a comparatively brief foray into the Southern Ocean. She was the first steam vessel to cross the Antarctic Circle, and conducted important oceanographic research and scientific observations on Prince Edward Islands, Iles Crozet, Iles Kerguelen, Heard Island, McDonald Islands (examining the coasts), making charts of each locality which remained the basis of several charts for almost a century. The earliest known photographs of Antarctic icebergs and of peri-Antarctic islands were taken during this expedition. Marine biology was a specialised study and much specially designed apparatus was developed.

International Research

The earliest coordinated international polar research occurred with the expeditions to observe the Transit of Venus on 9th December 1874 (see Plate 7). These established stations on the Auckland Islands, Campbell Island, Iles Kerguelen, and Ile Saint-Paul (several others had been planned). They were dispatched from Britain, France, Germany and the United States. The stations were occupied for several months, which provided many opportunities for collecting. A summary of these expeditions is as follows (Headland, 1989):

(1) Two French expeditions. The first was led by Amédée-Ernest-Barthélemy Mouchez (chief astronomer) aboard *Dives*. They observed the Transit from Ile Saint-Paul. Charles Vélain and M. de l'Isle made natural history observations there and on Ile Amsterdam. The second, led by Jean-Jacques-Anatole Bouquet de la Grye aboard *Vire,* tried to observe from Campbell Island but could not because of cloud; Henri Filhol made the natural history observations and collections

(2) A United States expedition, led by George P. Ryan aboard U.S.S *Swatara* with U.S.S. *Monongahela*, observed the Transit from Pointe Molloy, Golfe du Morbihan on Iles Kerguelen, and made natural history observations *Monongahela* also visited Iles Crozet, where botanical collections were made.

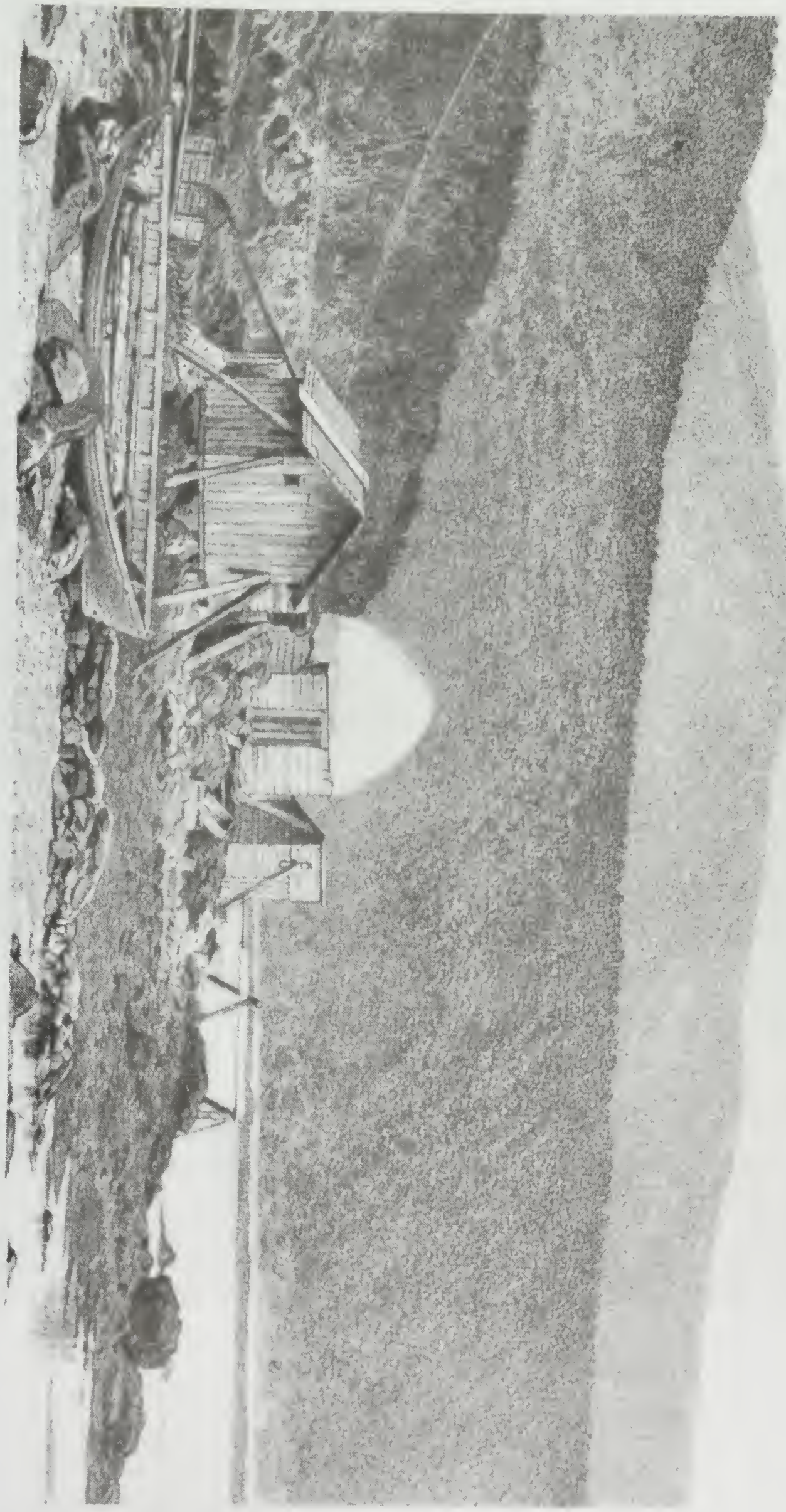


Plate 7: A Transit of Venus Observatory (Illustration from Jacquemart, 1882)

(3) A British expedition, led by J.L. Wharton with Stephen Joseph Perry as chief astronomer, sailed aboard H.M.S. *Volage* and H.M.S. *Supply*. They observed the Transit from three places: Baie de l'Observatoire, Baie des Swains, and Le Pouce, on Iles Kerguelen. Alfred Edwin Eaton made the natural history observations. The expedition introduced rabbits, cattle, goats and sheep as food for castaways (with subsequent severe effects on the vegetation by the first). The expedition met the United States sealers Captain Joseph Johnson Fuller (*Roswell King*) and Captain Bailey (*Emma Jane*), who provided local advice.

(4) Two German expeditions were also dispatched. The first, led by Karl Börgen with Ladislaus Weineck as chief astronomer, aboard *Gazelle*, observed the Transit from Anse Betsy on Iles Kerguelen, where it also conducted surveys and made collections. The expedition also visited Iles Crozet, Ile Saint-Paul, and Ile Amsterdam. The second, led by H. Seeliger aboard *Alexandrine*, landed at Terror Cove, Auckland Islands to make a second series of observations, but weather prevented this. They remained four months, recording geophysical and meteorological data, and conducting biological investigations.

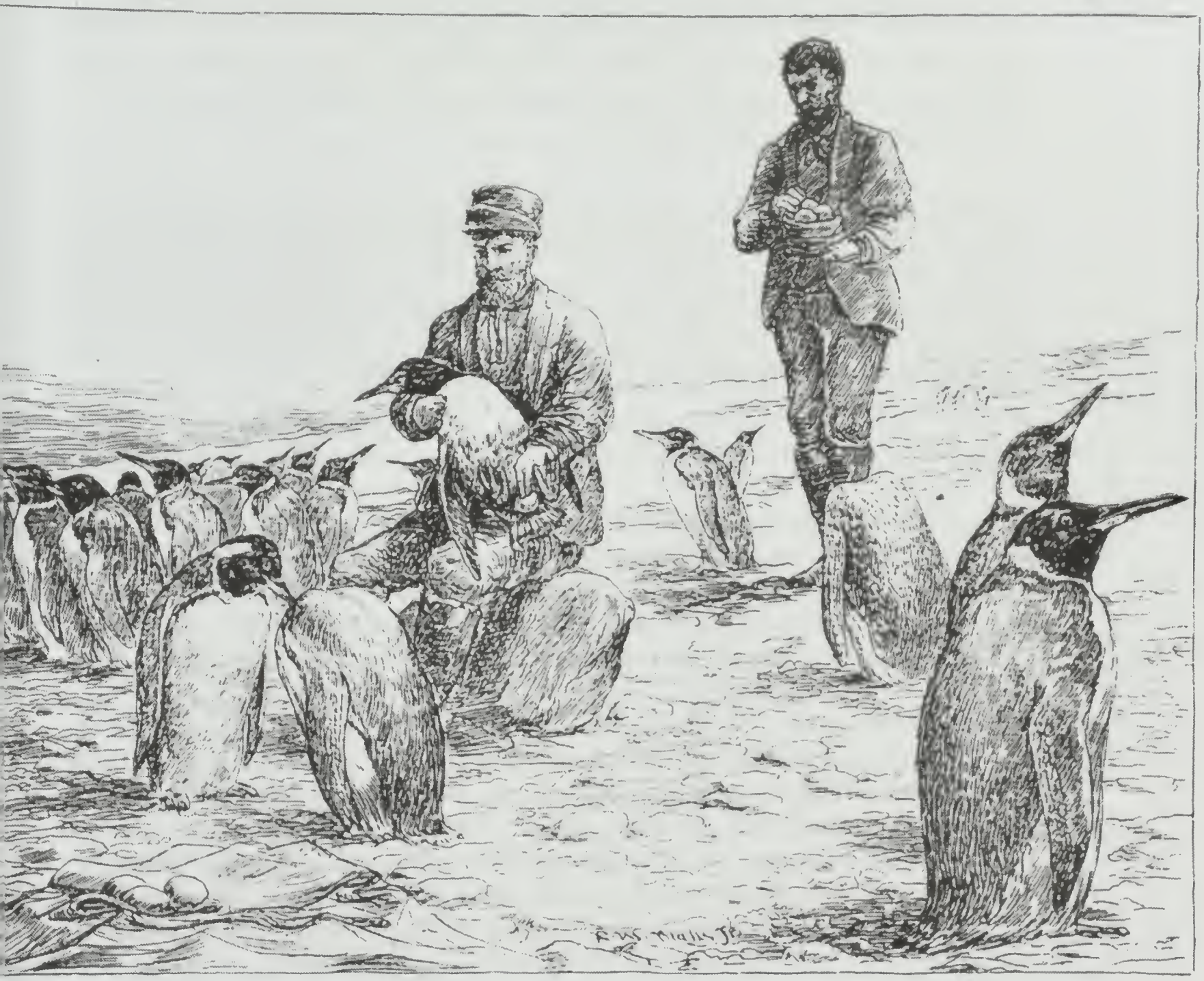
Shipwrecks

Tackling this subject chronologically is perhaps the most efficient course, but there is the occasional disarray. One of these is an interesting sidetrack. Macquarie Island, Campbell Island, and the Auckland Islands had been major sealing islands until the seals became near-extinct. The positions of these, and neighbouring islands, were such that many vessels were wrecked on them. After 1880 the New Zealand government instituted annual voyages to search for castaways and to maintain depots for shipwreck survivors. These voyages allowed many opportunities for naturalists to visit and, until the voyages stopped after radio became common at sea, many important collections had been made. Incidentally, some of these voyages were the beginning of Antarctic tourism. Opportunistic voyages also took naturalists to various other islands at various times up to the major natural history collections of Robert Cushman Murphy on South Georgia in 1911.

Penguins

Another aside with sealers was the solution of a mystery; whether King and Emperor Penguins had a pouch, like marsupials. It had been observed that they built no nests and that the egg or chick was accommodated beneath a parent. The question remained as to how was this achieved. The ornithologist George Verrill took advantage of the latest technology to investigate the problem A celluloid

E AUK VOL XI PLATE VIII



KING PENGUIN (APTENODYTES LONGIROSTRIS).

(Drawn from a Photograph.)

Plate 8

King Penguins photographed on Iles Kerguelen

(Illustration from Hazard, 1894)

film box camera was suplied to the New Bedford sealing master, Joseph Fuller, who sailed in command of *Francis Allyn* to Iles Kerguelen. Fuller photographed King Penguins there for analysis later. The photographs came out badly, but were sufficient to demonstrate that it was a flap of vascularised skin, not a pouch, which provided the incubation (Plate 8).

Later, Verrill arranged for several sealers to make natural history collections for him. George Comer, who wintered on Gough Island and collected birds, provided a very good example (Verrill, 1895). Similarly, the collection of geological specimens from South Georgia, which are now lodged in the Hunterian Museum of Glasgow University (Durant and Farrow, 1999), is a good example of the application of opportunities arising during sealers' voyages.

International Polar Commission

In October 1879 an International Polar Commission was formed at a conference in Hamburg, following a plan for coordinated international polar investigations proposed by Karl Weyprecht of the Austrian navy. Subsequent conferences followed. As a result, the first International Polar Year of 1882-83 was organized. Several Antarctic stations were planned but only one resulted (in contrast there were 32 around the Arctic).

The German International Polar Year Expedition, led by Karl Schrader, sailed in 1882 aboard *Moltke* to arrive at South Georgia, where a scientific station was established at Royal Bay in August 1882. Observations included geophysics, meteorology, glaciology, and biology until the station closed just over a year later. Comprehensive collections were made by the botanist, Hermann Will, with the medical officer, Karl von der Steinen, working as the zoologist (Neumayer, 1890-91).

Summary

To summarise, during the 'sealing period' there were over 1,100 Antarctic sealing voyages but only 25 scientific expeditions are recorded. From this period there remain sealers' relics on the majority of the peri-Antarctic islands. These are the enduring try-pots, many graves, caves with habitation remains, some cabin ruins, and the occasional stone carving. A few relics from the scientists also remain, principally inscribed stones marking reference points for later measurements. All this activity was largely uncoordinated with quite intermittent progress - but laid a foundation for what was to follow.

CONTINENTAL EXPLORATION

The Heroic Age of Exploration

This period began, in practice, with two pioneer voyages sailing in 1892, one from Britain and the other from Norway, both to make whale reconnaissances.

The Dundee whaling fleet was led by Alexander Fairweather aboard *Balaena*, accompanied by Thomas Robertson (*Active*), Robert Davidson (*Diana*), and James Davidson (*Polar Star*). The vessels visited the Falkland Islands and continued south towards the Joinville Island group and northern Trinity Peninsula. William Speirs Bruce and Charles W. Donald were able to record natural history notes and collect some specimens, although not as much as desired in either instance. William Gordon Burn Murdoch, an artist, also accompanied the expedition (Murdoch, 1894).

The Norwegian voyage was led by Carl Anton Larsen aboard *Jason*, from Sandefjord. It operated in essentially similar regions, but also penetrated farther south in the western Weddell Sea where the Foyn Coast was discovered. Larsen also visited the South Orkney Islands and collected fossils on Seymour Island (Bogen, 1957).

The two expeditions met near Joinville Island on 24th December 1892. Neither expedition was able to take whales successfully, but both returned with large quantities of seal skins and oil (presumably from Crab-eater Seals) which barely covered the expenses. The Dundee whalers concluded that the industry could not profitably work in the south, but the Norwegians returned with improved equipment and later began the whaling period of the Southern Ocean. For William Bruce it was the beginning of a profound Antarctic interest.

The 'continental penetration' period includes the expeditions of the 'Heroic Age' of Antarctic exploration together with the beginnings of the modern whaling industry. Interest in Antarctica was strong during this time, and was exemplified by the Fifth International Geographical Conference held in London in 1895. Resolution 3, adopted unanimously, was:

> "That this Congress record its opinion that the exploration of the Antarctic Regions is the greatest piece of geographical exploration still to be undertaken That in view of the additions to knowledge in almost every branch of science which would result from such a scientific exploration the Congress recommends that the scientific societies throughout the world

should urge in whatever way seems to them most effective, that this work should be undertaken before the close of the century".

The resolution marked the theoretical beginning of the period, the 'Heroic Age' (Keltie and Mill, 1896).

This period is typified by the earliest winterings made south of the Antarctic Circle (1898, aboard *Belgica*) and on Antarctica (1899, at Cape Adare). The last of the peri-Antarctic islands (Scott Island) was discovered in 1902, and the general limits of Antarctica became known. The South Pole was reached twice during the 1911-1912 summer (33 days separated these events). The earliest Antarctic cinematograph films were made in 1898. Radio communications were established between Antarctica and Australia in 1912, through a relay station on Macquarie Island. In 1903 the first permanent meteorological station was opened (on the South Orkney Islands) and in 1904 the first shore whaling station was established (on South Georgia).

One example provides an illustration of how incomplete was the knowledge of Antarctic natural history at the end of this period. Barely a century ago, in his preparations for the first continental winter, Carsten Borchgrevink purchased a supply of large calibre rifles and a large store of suitable ammunition. He had, quite sensibly, been prepared for attack by a large predatory land mammal, like the Polar Bear of the Arctic (Borchgrevink, 1901). The ammunition lies corroding beneath penguin guano to this day, in a site declared historic under the provisions of the Antarctic Treaty.

This account of the early voyages associated with the natural history of Antarctica, particularly natural history and the sea, has been episodic, as has been the activity during the period. Subsequent papers presented at this Conference will indicate where, with this foundation of the history of natural history, the advance of knowledge becomes intense. The *Discovery*, now moored alongside the building where this Conference is taking place, provides a most tangible example of this age of discovery of the natural history of Antarctica.

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THE NATURAL HISTORY OF THE *DISCOVERY*'S ANTARCTIC VOYAGES, 1901-1931

By ANN SAVOURS
Canterbury, Kent

Introduction

The auxiliary barque *Discovery* was built by the Dundee Shipbuilders Company and launched on 21st March 1901. In 1900 Dundee was notable chiefly for its harbour, its shipbuilding, and its manufacture of jams and jute. For decades, much of the canvas for the Royal and Merchant Navies had been spun in Dundee, and the victor of the naval battle of Camperdown in 1797, Admiral Duncan, was born there. In the days before the bulk handling of grain, jute sacks were of great importance in the harvesting of the crop world-wide.

Wooden shipbuilding in Dundee attained its zenith in the 1840s, involving the firms of Alexander Stephen, David Calman, Thomas Adamson, John Calman, and John Brown. One of the largest vessels of the time, the *Eastern Monarch* (1,840 tons, builders' measurement) was launched at Stephen's yard in 1846. Steam vessels of iron or steel thereafter gained the ascendancy, among them the first steam whaler, the *Tay*, despatched to the northern whale fishery in 1857, to be joined there subsequently by many others to form the Dundee whaling fleet (Thompson, 1912).

The late 19th century saw the rapid decline of Scottish whaling owing to the near extinction of the Greenland Right Whale and to the fall in demand for whale products. In Dundee, however, the importance of whale oil in the manufacture of jute kept the whaling industry alive until 1909. Four vessels from the Dundee whaling fleet made a pioneer reconnaissance to the Antarctic in 1892-93, but failed to find there the numerous Southern Right Whales which had been reported by an exploring expedition fifty years previously. Scottish whaling was done in the old style, with a parent ship and small boats from which the whale was harpooned.

Many whalers and sealers were built by the Scottish firm of Alexander Stephen and Sons at their Panmure Shipyard in Dundee. These included the *Nimrod*, 1866, the old *Discovery* (ex-*Bloodhound*), 1872, and the *Terra Nova*, 1884 In 1894 Stephen and Sons vacated the shipyard, which was taken over by the newly formed

Dundee Shipbuilders Company, the builders of the *Discovery* in 1901 (Walker, 1980).

The *Discovery*'s sea-going career ended thirty years later as she steamed up the Thames in August 1931. Between these dates she lived the life of a scientific and exploring ship during three voyages to the Antarctic: the first in 1901-04 under Captain R.F. Scott; the second in 1925-27, directed by Dr. S.W. Kemp; and the third led by Sir Douglas Mawson in 1929-31. During the intervening years she worked as a small merchant vessel, carrying cargoes to different ports in the northern hemisphere, when of course no scientific work was done.

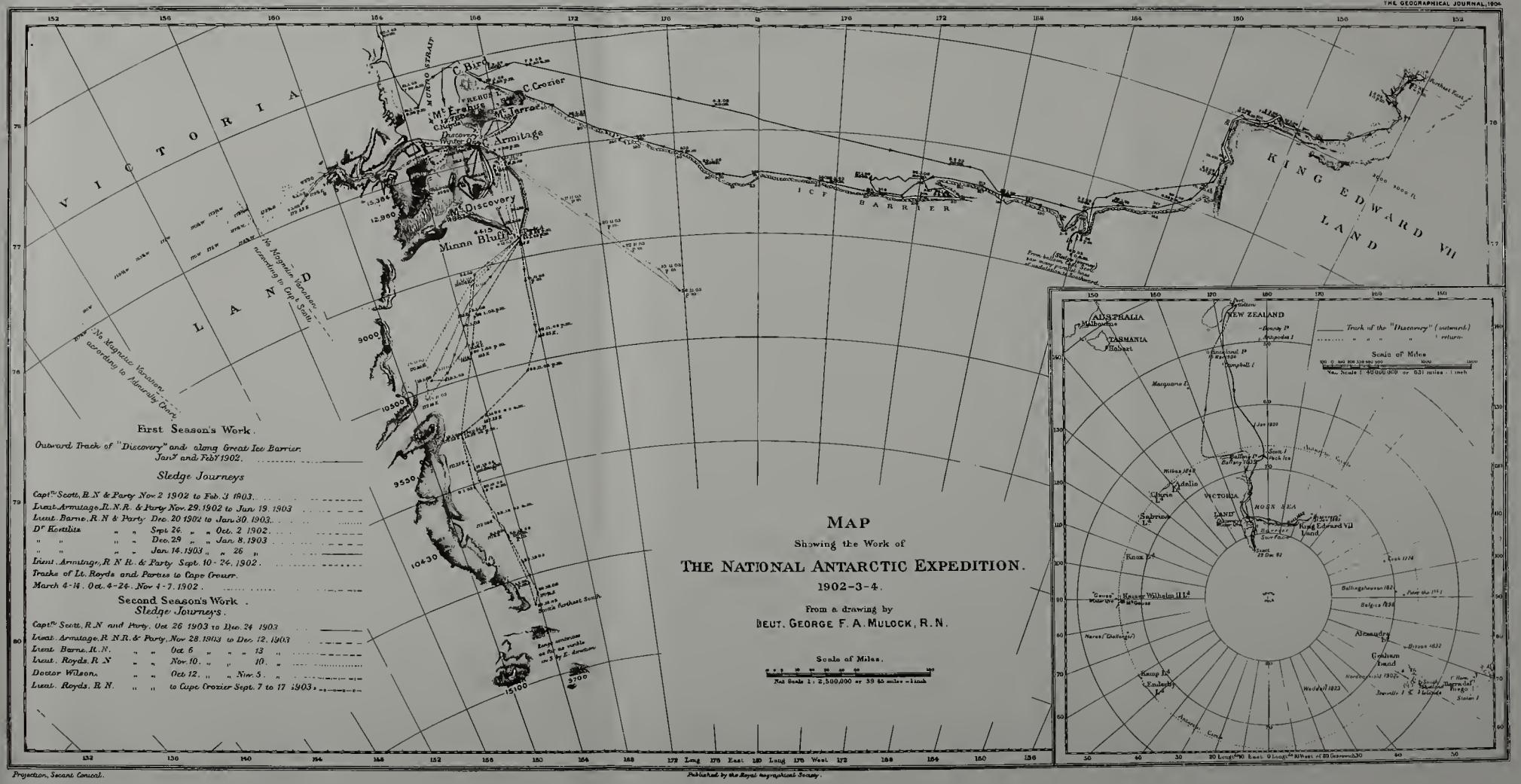
The aim of this paper is to say something about the origins of each Antarctic voyage, to provide a short narrative, to give an account of the field work and a summary of the natural history results, and to introduce some members of each expedition.

THE NATIONAL ANTARCTIC EXPEDITION, 1901-1904

Sir Clements Markham

The S.Y. *Discovery* (auxiliary barque) was designed by W.E. (later Sir William) Smith on the lines of Captain G.S. (later Sir George) Nares' *Discovery* (formerly the Dundee steam whaler *Bloodhound*). The designer's aim was to produce a vessel strong enough to withstand the pressure of ice, yet able to navigate the high seas. The 'father' of the National Antarctic Expedition was Sir Clements Markham, who, as President of the Royal Geographical Society, got the expedition under way. The expedition (Figure 1) was organised jointly by the Royal Geographical Society and the Royal Society, with some Government backing, and the *Discovery* was constructed through the generosity of Mr. Llewellyn Longstaff; Markham became the vessel's 'managing owner', on behalf of the R.G.S., and as such appears on the ship's papers.

Sir John Murray, the distinguished oceanographer and editor of the *Challenger*'s scientific results, saw the National Antarctic Expedition as a sequel to the *Challenger*'s great oceanographic voyage of 1872-76. However, this did not suit Sir Clements Markham, who was against a lot of "mud-larking" with drags and nets. His wishes prevailed, and the *Discovery* sailed from Cowes in August 1901, bound for the Ross Sea. Markham's axiom was to go from the known into the unknown, with the hope of exploring the 'Icy Barrier' of the supposed Antarctic continent and beyond into its interior. In this the expedition was very successful,


MAP
Showing the Work of
THE NATIONAL ANTARCTIC EXPEDITION.
1902-3-4.
From a drawing by
LIEUT. GEORGE F. A. MULOCK, R.N.
Scale of Miles.
First Season's Work.
Outward Track of "Discovery" and along Great Ice Barrier. Jan.y and Feb.y 1902.
Sledge Journeys
Capt.n Scott, R.N & Party Nov.r 2 1902 to Feb.y 3 1903.
Lieut. Armitage, R.N.R. & Party Nov.r 29, 1902 to Jan.y 19, 1903
Lieut. Barne, R.N & Party Dec.r 20 1902 to Jan.y 30, 1903.
Dr Koettlitz " " Sept.r 26 " " Oct.r 2 1902.
" " " " Dec.r 29 " " Jan.y 8, 1903
" " " " Jan.y 14, 1903 " " 26 "
Lieut. Armitage, R.N.R. & Party Sept.r 10-24, 1902.
Tracks of Lt. Royds and Parties to Cape Crozier.
March 4-14, Oct.r 4-24, Nov.r 4-7, 1902.
Second Season's Work.
Sledge Journeys.
Capt.n Scott, R.N and Party, Oct.r 26 1903 to Dec.r 24 1903
Lieut. Armitage, R.N.R. & Party, Nov.r 28, 1903 to Dec.r 12, 1903
Lieut. Barne, R.N. " " Oct.r 6 " " " 13 "
Lieut. Royds, R.N " " Nov.r 10. " " 10. "
Doctor Wilson. " " Oct.r 12. " " Nov.r 5. "
Lieut. Royds, R.N. " " to Cape Crozier Sept.r 7 to 17 1903.
VICTORIA LAND
KING EDWARD VII LAND
BARRIER
C. Bird
C. Crozier
Mt. Erebus
Mt. Terror
C. Armitage
Mt. Discovery
Minna Bluff
No Magnetic Variation according to Capt.n Scott
No Magnetic Variation according to Admiralty Chart
Scale of Miles.
Nat Scale 1 : 2,500,000 or 39.45 miles = 1 inch
AUSTRALIA
Melbourne
TASMANIA
Hobart
NEW ZEALAND
Track of the "Discovery" (outward)
" " " " return
Scale of Miles
Adelie L.d
Oates L.d
Sabrina L.d
VICTORIA LAND
ROSS SEA
King Edward VII Land
Knox L.d
Kaiser Wilhelm II L.d
Balleny Is.
Alexandra L.d
Graham Land
Kemp L.d
Enderby L.d
Antarctic Circle

Projection, Secant Conical.

Published by the Royal Geographical Society.

Figure 1

(Facing page 38)

Map from the *Geographical Journal*, Vol. 24, August 1904.

making the first extensive inland sledging journeys. Having established winter quarters beneath the active volcano Mount Erebus on Ross Island, under the leadership of Commander Robert Falcon Scott, members of the expedition reached 82°16'33' South on the Ross Ice Shelf, and travelled beyond the Western Mountains to the polar plateau, besides making many other journeys. King Edward VII Land, at the further end of the Ross Ice Shelf, was discovered during the outward voyage. A comprehensive scientific programme was carried out. The expedition wintered on board ship, but also constructed the hut at Hut Point, where the hut still stands.

The relief ship *Morning* (Captain W. Colbeck) made two voyages, accompanied by the *Terra Nova* (Captain H. Mackay) during the second voyage in 1903-04. The *Discovery,* having been released from the ice of McMurdo Sound, completed her circumnavigation (mainly between latitudes 40° and 60° S) during the southern winter of 1904, finishing her magnetic programme and searching for the non-existent 'Dougherty Islands'. On her return to England, unsuccessful efforts were made to persuade the British Government to employ the *Discovery* as a scientific or fisheries research vessel. Having cost £45,000 to build, she was sold for £10,000 to the Hudson's Bay Company as a supply ship. However, this lesser sum did pay for the lavish publication of the scientific results by the British Museum and the Royal Society.

The *Discovery* had been preceded into the Ross Sea sixty years earlier by the original discoverer of the sea, the great polar navigator Sir James Clark Ross, in H.M. Ships *Erebus* and *Terror* during their circumnavigation of the Antarctic in 1839-43. Only three years before the *Discovery* sailed, a private expedition, led by C.E. Borchgrevink in the *Southern Cross,* had followed in Ross' wake along the 'Great Ice Barrier', known now as the Ross Ice Shelf. Its members made the first intentional wintering in the Antarctic at Cape Adare. Because of the death of Nicolai Hanson, the zoologist, it fell to two members of the scientific staff of the National Antarctic Expedition to write up part of the results of the *Southern Cross* expedition, before sailing for the Antarctic: Dr. Edward A. Wilson (1902) contributed 'Notes on Antarctic seals', with four plates, done from skins and skeletons, while T.V. Hodgson (1902) examined the crustacea. The publication of the diaries of L.C. Bernacchi, physicist, has shed new light on the scientific (and other) aspects of this pioneering expedition (Crawford, 1998).

Robert Falcon Scott

Commander R.F. Scott had been appointed to lead the National Antarctic Expedition largely on the recommendation of Sir Clements Markham and of one of

the officers of the British Arctic Expedition of 1875-76. Following in the tradition of the Royal Naval polar voyages of the 19th century, Scott took charge not only of the *Discovery* at sea and in winter quarters, but also of the scientific work of the National Antarctic Expedition. He allowed each specialist full rein, but with the proviso that progress should be regularly reported in an open book for all to see.

One hundred years ago, this expedition was the first to make extensive geographical and scientific observations on the seventh continent, whose limits had been defined by Captain Cook in the 18th Century and which had been seen only by a handful of other mariners since then. By reading Captain Scott's excellent narrative of the expedition, we can still accompany him and the other members on this exciting, demanding and rewarding first truly-scientific expedition purposely to winter in the high latitudes of the Antarctic (Scott, 1905). In a chapter at the end of the second volume, Scott collected together the main facts and observations of the expedition, in order to show the reader that the voyage of the *Discovery* "was not conducted in a spirit of pure adventure, but that we strove to add, and succeeded in adding, something to the sum of human knowledge". He also wrote for the benefit of those who would want to follow after them (Scott, 1905: 434-435). There then followed two appendices, the first by H.T. Ferrar summarising the geological observations, and the second by Dr. E.A. Wilson on the fauna of the Antarctic (Scott, 1905: 437-494).

Some Highlights of Natural History

This paper can only highlight some of the expedition's achievements in natural history. One of the most significant must be the discovery in the Western Mountains by the young geologist, H.T. Ferrar (Plate 1), of the first evidence of Antarctic life in the geological past. He found that some sandstone blocks in a moraine were "locally blackened by carbonaceous matter". Then at the base of a sandstone cliff, "when arriving with bag and hammer at the rock-face", he was delighted to discover "thin, black, irregular bands in a pure white sandstone", from which he collected a few specimens of much-charred carbonaceous material (Ferrar, 1907). However it was not until 1928 that the find of *Glossopteris* fossils in a large block of Ferrar's shale, much further south than those collected on the Antarctic Peninsula by the Swedish expedition of 1901-04, was published (Edwards, 1928). The Beacon Sandstone formation was so named by Ferrar, after the Beacon Heights reached by A.B. Armitage during his pioneering journey through the Western Mountains in the first summer sledging season, 1902-03. In this same field report, Ferrar described the sea ice, land ice, and snow, as well as noting the recession of ice in both polar regions (Ferrar, 1907: 99).

Plate 1

H.T. Ferrar

Geologist, after whom the Ferrar Glacier is named

Captain Scott discovered an extraordinary manifestation of this recession. After marching for many days in December 1903 over the monotonous and desolate plateau of the Antarctic ice sheet, he, with Petty Officer Edgar Evans and Leading Stoker William Lashly, entered and explored one of the "dry valleys" of the Antarctic. He described the wildness and beauty of this "very wonderful place", its sandy floor littered with heaps of boulders, and gleaming occasionally with the white surface of a frozen lake or the silver threads of little streams. Above were the "snow-splashed mountain peaks, between which in places fell ... the folds of some hanging glacier". They had penetrated what Scott called "a valley of the dead", where once there had been "colossal ice action and considerable water action, yet neither of these agents is now at work". They had seen no living thing - not even a moss or lichen - only "far inland among the moraine heaps ... the skeleton of a Weddell Seal, and how that came there is beyond guessing" (Scott, 1905: 292-293).

In a pocket at the end of the Geological Report can be found a large folding "Map of the district near the *Discovery* winter quarters" (Ferrar, 1907: map). Dated 1906, this was coloured by Ferrar to illustrate the geology. The map was drawn by Lieutenant G.F.A. Mulock; it shows the mountains, the glaciers and other features, including the dry valleys.

In contrast to the youthful Ferrar, whose good fortune it was to take the place of the celebrated Professor J.W. Gregory as geologist on the expedition (Holland, 1986), the marine biologist, T.V. Hodgson, was in his late thirties, with an established scientific record. Besides examining and sorting the collections made from nets towed astern of the *Discovery* during her outward voyage, Hodgson was successful in obtaining specimens from under the ice in the vicinity of Hut Point during the winter. He described his work in an interesting section of the scientific results, entitled 'On collecting in Antarctic seas' (Hodgson, 1907). These collections and those of Dr. Reginald Koettlitz, the senior surgeon, went a long way to prove in the words of F. Jeffrey Bell, the editor of the natural history reports, that "The Antarctic region, instead of being, as we might imagine, with its inhospitable climate, almost devoid of life, teems with species, of which 227 new forms are described in these volumes" (Bell, 1912).

Edward Adrian Wilson

The junior surgeon, and zoologist, of the *Discovery* was Dr. Edward A. Wilson, whose diary of the National Antarctic Expedition was published in 1966. He has attracted much admiration not only for his scientific work, but for his

drawings and watercolours and for his character as a man (Savours, 1966). Wilson depicted, observed and collected the marine mammals and the birds of the Antarctic. The results of his work can be seen in the Zoology Report of the expedition (Wilson, 1907b), in an appendix to Scott's book, already mentioned (Scott, 1905: 437-494), in several scientific papers (e.g. Wilson, 1905a and 1905b), and in a book comprising his studies of Antarctic birds, edited by Dr. Brian Roberts and published in 1967 (Roberts, 1967).

In his work Wilson was helped in particular by Petty Officer Jacob Cross, who became expert in bird skinning (Plate 2), and by Engineering Lieutenant Reginald Skelton, who took many of the photographs and who also collected and made observations. The expedition was the first to discover a nesting colony of Emperor Penguins *Aptenodytes forsteri*, at Cape Crozier on Ross Island (Plate 3), which Wilson was able to visit during the second summer season. (He had accompanied Scott and Shackleton on the southern sledge journey during the first). The extraordinary life cycle of the Emperor Penguin in laying its eggs and hatching its chicks during the depths of the Antarctic winter was not confirmed until Wilson, Cherry-Garrard and Bowers made their famous winter journey to the penguin rookery during Scott's *Terra Nova* expedition of 1910-13 (Cherry-Garrard, 1922). A valuable collection of eggs and frozen chicks was brought back by the *Discovery* party, after three painful nights camping when the temperatures dropped to the minus-sixties Fahrenheit. Wilson described the surviving live chick, which he looked after in his cabin on his return, as follows:

> "He is a regular caution, frightfully wayward and obstinate, and very vicious, losing his temper and grizzling in the most human fashion, pecking as hard as possible if he isn't allowed to do exactly as he wishes. He has me out of bed regularly twice every night, chirruping in the most ear-piercing way till I feed him with chewed seal meat, and then he insists on being fed full every four hours throughout the day. He likes sitting up late to look at the candle and gets frightfully angry, struggling and chirruping in his box if I put him to bed early. He is covered with the softest silky grey down and his head is made of black and white velvet in beautiful contrast. Only his figure is shockingly aldermanic, just about as ugly as can be" (Savours, 1966: 293-294; Wilson diary entry for 13.9.03).

Wilson's studies in water-colour of the frozen and live chicks, as well as those of other fauna, can be found in the Scott Polar Research Institute, Cambridge. Both Wilson and Hodgson contributed well-illustrated articles to the expedition's

Plate 2

Bird skinning on the way South

Petty Officer Jacob Cross (left) and Dr. Edward Wilson (right)

Plate 3

Emperor Penguins

Cape Crozier, Ross Island

(Photograph by Engineering Lieutenant Reginald Skelton)

magazine, *The South Polar Times*. This was published in two volumes in 1907, as a delightful facsimile.

On the return of the National Antarctic Expedition in September 1904, it fell to Dr. Wilson to play a very considerable and practical part in the production of the scientific results. In the archives of the Royal Society of London can be found his nineteen letters sent between 1906 and 1908 to Sir Archibald Geikie, the society's then Secretary and later President, who was responsible overall for the physical results. Many of the letters were written from Scotland, where Wilson was investigating grouse disease. They show that he was always anxious that his colleagues should be given due credit for their work (Royal Society Archives, reference MM 11. 113-131).

The major part of the published Zoology Report of the expedition (Volume 2) comprises Wilson's reports and 18 fine plates of mammals and birds (Wilson, 1907b). It also includes the birds collected by Dr. G.A. Davidson, surgeon of the relief ship, the *Morning*. Wilson stressed the debt owed by members of the expedition to Sir Clements Markham. He also remarked in his Introduction that all the naval officers went out of their way to help the scientific staff "by observation, or by practical and often heavy and unpleasant labour". He paid a glowing tribute to Captain Scott's "untiring interest ... in the scientific work of those who were placed under his command". It was to "the interest and good will" shown by the Scott "in all our work that such results as we have been able to collect are very largely due" (Wilson, 1907a).

Terra Nova Expedition

Both Captain Scott and Dr. Wilson were to return to the Antarctic with the *Terra Nova* expedition of 1910-13. The news of their deaths came as the last volume of the *Discovery*'s scientific results was published in 1913. An addendum dated 14th February 1913 to Sir Archibald Geikie's preface expressed the "profound sorrow" filling the hearts of all at the deaths of the South Pole party. He concluded:

> "We had learnt to appreciate the remarkable gifts of Captain Scott and Dr. E.A. Wilson and their charm as personal friends. We looked forward to their return home, bringing with them another and still ampler harvest of results. They have lost their lives in the cause of science, but their names are now imperishably graven on the bede-roll of the heroes of polar discovery" (Geikie, 1913).

THE *DISCOVERY* (OCEANOGRAPHIC) EXPEDITION, 1925-1927

Stanley W. Kemp

After some twenty years in the ownership of the Hudson's Bay Company, the *Discovery* was bought in 1923 by the Crown Agents for the Colonies for the purpose of "scientific research in the South Seas" and so began her second venture to the Antarctic, the *Discovery* (Oceanographic) Expedition of 1925-1927 (Figure 2). This differed from the earlier voyage in that its aim was not largely geographical, but scientific. Dr. Stanley Kemp, its Director of Research, was at pains to point out "that the *Discovery* Expedition differs widely from any previously undertaken in the south, that the exploration of unknown regions, with its glamour and hardship, finds no place in this programme, and that it pursues by methods which are relatively prosaic a line of enquiry which is closely directed to the solution of a particular economic problem". The "particular economic problem" was "a biological one, occasioned by the rapid expansion of the southern whaling industry in recent years". Thus the expedition's main object was "biological and not geographical" (Kemp, 1928).

A characteristic of Arctic whaling in earlier centuries had been to take no thought for the morrow, and to kill off the whales which provided oil and whalebone until it was no longer profitable to pursue them. The first whaling station in the South was established at Grytviken, South Georgia in 1904 (Plate 4), and during the next two decades, this island, in Dr. Kemp's words, writing in the late 1920s "together with the South Orkneys and the South Shetlands, all of which are Dependencies of the Falkland Islands" became "the centre of the greatest whaling industry which has ever existed" (Kemp, 1928). The whalers were largely Norwegians from the Oslofjord.

Whaling Licences

A system of licences had been evolved by the Colonial Office in London even before the First World War, and the well-known zoologist, Major G.E.H. Barrett-Hamilton, a close friend and old colleague of Dr. Edward Wilson, was despatched during the 1913-14 season to work on the whale carcases in South Georgia. Most unfortunately, however, Barrett-Hamilton, died suddenly on 17th January 1914, after only a few weeks of work in South Georgia. An interdepartmental committee was set up, known at first as the Interdepartmental Committee on Research and Development in the Dependencies of the Falkland Islands, and later (after the purchase of the ship) as the Discovery Committee. In 1920 the Committee published a Parliamentary report. Rowland (E.R.) Darnley of the Colonial Office

Figure 2

The South Atlantic and Southern Oceans, showing the tracks of R.R.S. *Discovery* and R.S. *William Scoresby*, 1925-1926 and 1926-1927

Based on maps in the *Geographical Journal* (Hardy, 1928), and *Discovery Investigations, Second Annual Report*, 1929

Map drawn by Vera Brice

Plate 4

The shore station at King Edward Point, Grytviken, South Georgia looking across to the whaling station

(Photograph by courtesy of Southampton Oceanography Centre)

maintained that "concealed in a somewhat unwieldy body, this Blue Book had a soul". This, he believed, "consisted in a proposal for the employment of research ships on a scale comparable with the expeditions of the *Michael Sars* or the *Challenger*" (see Darnley, 1923).

Discovery Committee

The Committee was convinced of the need to study the entire marine environment of the whale, as well as its biology, in order to provide a scientific basis for regulating the numbers taken each season. There was at that time no question of abolishing whaling because of its cruelty. Sir Sidney Harmer, Director of the British Museum (Natural History), was one of those most concerned to preserve the great whales. In 1922 he wrote "The efforts of all lovers of Nature should be directed to the restriction of whaling to an amount which is not inconsistent with the permanent preservation of these magnificent marine mammals and of the industry which they are so unfortunate to support (Harmer, 1922). Another prime mover was E.R. Darnley of the Colonial Office, who initiated the proposal to send a scientific expedition to Antarctic waters and who became Chairman of the Discovery Committee.

After her sale to the Crown Agents in 1923, the *Discovery* underwent repairs and modifications to improve her sailing qualities and in some respects she was practically rebuilt. A ward room was provided once again, together with chemical and biological laboratories, winches, water bottles, sounding apparatus, outboard platforms and other oceanographic equipment for her new life as a Royal Research Ship in the waters of the Southern Ocean.

First Antarctic Voyage

The R.R.S. *Discovery* finally departed for the south in October 1925. The leader of the expedition and Director of Research was Dr. S.W. Kemp, formerly of the Zoological Survey of India. The Chief Zoologist was A.C. (later Sir Alister) Hardy, whose narrative of the voyage, *Great Waters* (1967), is a joy to read Master of the *Discovery* was Commander J.R. Stenhouse R.N.R., an old sea-dog, who had been Master of Shackleton's *Aurora* in the Antarctic. He came from a family of Dumbarton shipbuilders, famous for their clipper ships. The early chapters of *Great Waters* describe the delights of sailing or steaming through the waters of the Atlantic in a wooden barque, examining the creatures of the sea from the surface and from the depths, experiencing the tropical nights with a shining wake of *Pyrosoma*, or riding by day in a bosun's chair beneath the bowsprit "fishing out treasure after treasure" as they came floating past.

Touching at the Cape and at Tristan da Cunha, the *Discovery*'s first southern voyage of this South Atlantic expedition was from January to June 1926, during which a series of "standard vertical stations" were completed. Samples of sea water and measurements of temperature were taken at various depths. The long plankton nets and water bottles were lowered into the sea on wires from light deck winches. On each of the small folding outboard platforms stood a scientific officer, working the gear in concert with another on deck, who controlled the engine. Soundings were made with the Kelvin and Lucas machines. The ship had to be kept head to wind, no easy task when the depth was too great to anchor and when the *Discovery*'s heavy yards and rigging in a stiff breeze provided considerable resistance to the wind. The existence of a remarkable cold layer of water sandwiched between two warmer ones in about 50°S (the Antarctic Convergence) was proved, and later shown to have great importance in the lives of some plankton animals and plants, which make vertical migrations between the cold and warm layers. This system was revealed simultaneously yet independently in the South Atlantic by the *Discovery* Expedition and by the German Atlantic Expedition in the *Meteor*.

Whale Biology

Work on the dead whales brought in for flensing and rendering down into oil and meal was carried out ashore on South Georgia by the biologists of the marine station. This had been established in 1924 not far from the whaling station at Grytviken, as part of the scientific programme. The *Discovery* berthed near the whaling station in February 1926. Here the stench of the factory could almost be felt, and *Discovery* rode in water blood-red from the distended bodies of Fin and Blue Whales waiting to be hauled up on to the 'plan' or platform for dismemberment (Plate 5). The serenity of the icy mountain peaks above the fjord contrasted with the steam and frenzy of the factory, and the clamour of thousands of sea birds feeding on the offal. Hardy saw whale catching at first hand from a whale catcher, and found the playing of the whale on the line (as a fisherman does a salmon) a truly "barbarous business" (Hardy, 1967: 186).

Krill

The *Discovery* carried out the first provisional biological and hydrographical survey of the whaling grounds, the findings of which were amplified next season in company with the Research Steam Ship (later R.R.S.) *William Scoresby,* built to undertake whale marking, trawling and oceanographic work for the Discovery Committee. Of particular importance was the krill, a collective name given by

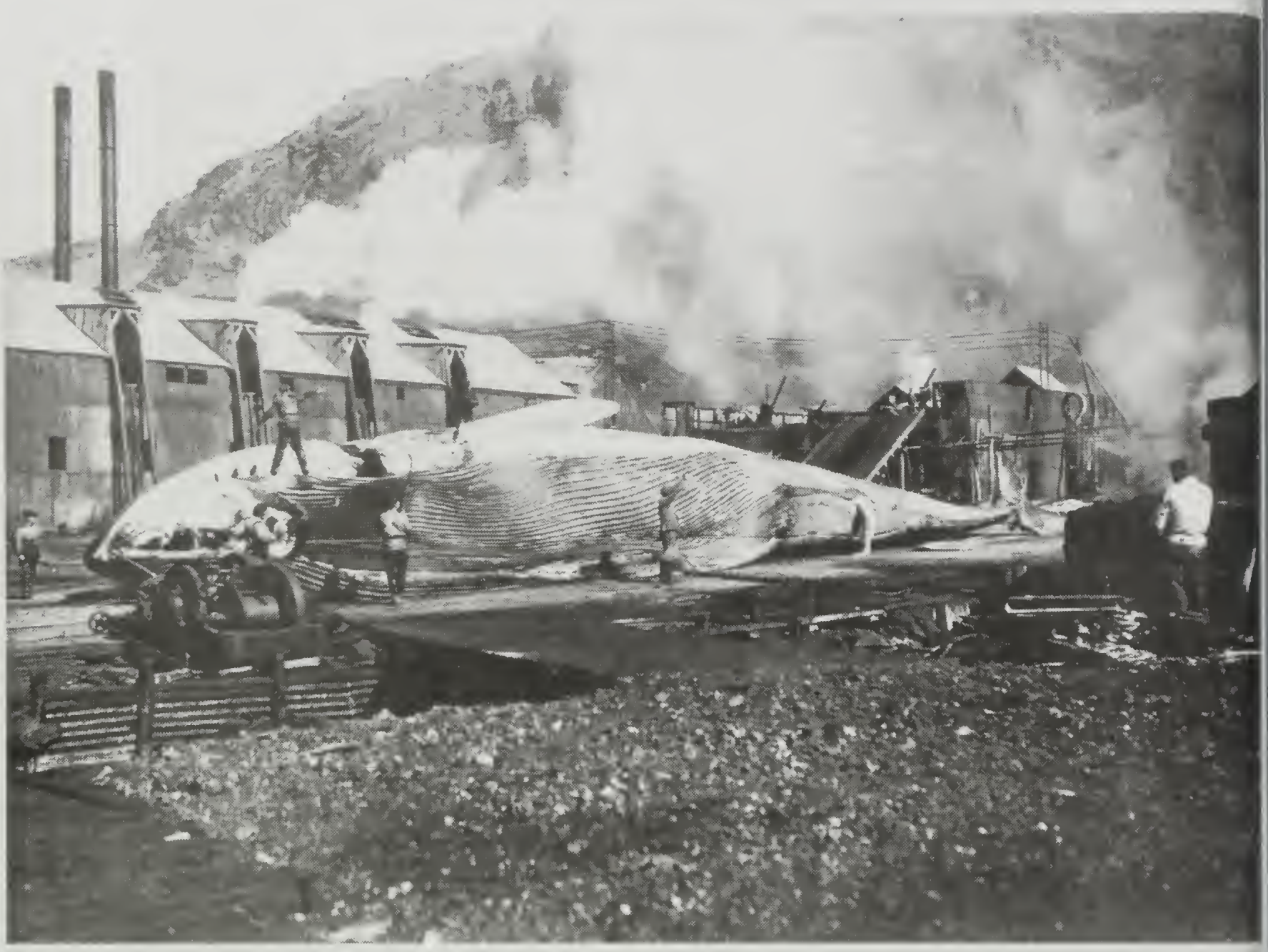


Plate 5

Flensing one of the great whales on the 'plan' of the whaling station, Grytviken

(Photograph by courtesy of Southampton Oceanography Centre)

whalers to the small shrimp-like crustaceans which congregate in great swarms and which are the food of the whalebone whales. Of the krill, Kemp was later to write:

> "*E. superba* is an abominable organism. It lives in small patches of great density at almost any level and even with our best endeavours we have not got any reasonably exact idea of its abundance. A series of surface nets, towed continuously for 25 miles ... gave astonishing results. 10,000 in one haul and 50 in the next - that sort of thing all the way" (Kemp, 1927).

Oceanographic Work

The remainder of the first season was spent in making a line of stations from South Georgia to the Falkland Islands. At Cape Town, the *Discovery* was fitted with bilge keels in the Royal Dockyard of Simonstown. Her rolling made oceanographic work very difficult and these keels were to improve matters somewhat. She made two short cruises north from the Cape - one to the whaling grounds off Saldanha Bay and the other to take a series of hauls with the large nets.

Second Antarctic Voyage

The second Antarctic voyage of this expedition lasted from October 1926 to June 1927. A more southerly course was taken this time, from Cape Town to South Georgia amid pack ice and icebergs, one of which nearly claimed the *Discovery*. The stations worked by the *Discovery* and *William Scoresby* from South Georgia during the second season's survey of the whaling grounds radiate like the spokes of a wheel from its hub. From this intensive survey came biological collections and water samples, which, after identification or analysis at home, presented an instantaneous picture of the whole living community of the whaling ground and its physical and chemical background. Thus the tiny plants and animals of the plankton, through its predator the krill, were linked with the great whales themselves. Additional investigations were also made in the bays and channels of the Antarctic Peninsula, Drake Passage and Bransfield Strait. Here Hardy's continuous plankton recorder came into its own.

The *Discovery* returned home to England on 27th September 1927, having traversed 37,000 miles and having made 299 stations from her decks. Sir Sydney Harmer pronounced the expedition to have been "the largest and most important scientific expedition that has left our shores since the time of the *Challenger*". This was said during the discussion which followed Hardy's lecture on the work of the *Discovery* to the Royal Geographical Society in April 1928 (Hardy, 1928).

The Discovery Investigations

Thus was begun a great series of Antarctic voyages, concerned largely with the biology and the environment of the whale. These were subsequently known as Discovery Investigations, from which stemmed the celebrated volumes of *Discovery Reports*, the first of which dealt largely with the "objects, equipment and methods" of the 1925-27 voyages (Kemp, Hardy and Mackintosh, 1929). Partly because of the reticence of Dr. Stanley Kemp, and the Committee's own dislike of publicity, the work of the Discovery Committee is even today relatively little known. The publication, forty years after the 1925-27 expedition, of a narrative of the voyage (Sir Alister Hardy's *Great Waters*), helped to some extent, since there he also discussed the results of later expeditions (Hardy, 1967: chapters 20 and 21). The Discovery Committee did, in fact, issue a succinct and well-illustrated *Report on the Progress of the Discovery Committee's Investigations,* under the auspices of the Colonial Office, London, in 1937. This summarized the work of the previous decade and listed the 73 papers published in the *Discovery Reports,* volumes 1-14, together with those still in preparation.

Sadly neither the whale, nor indeed the whaling industry, could benefit in the short term from the work. The advent of whale factory ships with stern slipways to haul up the whales meant that regulations framed for the shore stations could not be enforced, since the new vessels operated on the high seas, beyond their jurisdiction.

THE BANZARE VOYAGES, 1929-1931

Sir Douglas Mawson

The *Discovery* carried her third Antarctic expedition in 1929-31 (Figure 3). This was the British, Australian and New Zealand Antarctic Research (BANZARE) Expedition, led by the well known Australian explorer and geologist, Sir Douglas Mawson. Mawson had first gone south with Shackleton in the *Nimrod* (1907-1909), during which expedition he climbed Mount Erebus and sledged to the region of the South Magnetic Pole. He later organised and led the Australasian Antarctic Expedition of 1911 - 1914, discovering and exploring King George V Land and Queen Mary Land in Greater (East) Antarctica. A friendly man of great modesty and striking appearance, Mawson had a lusty and infectious sense of humour, as well as great determination and grit (Plate 6). One of his party called him "above everything, an intellectual leader", committed to science as much as was Dr. Stanley Kemp. Mawson outlined the object of the BANZARE expedition in an article for *The Times* (12th October 1929).

Plate 6

Frank Hurley filming,
watched by Sir Douglas Mawson

Figure 3

(Facing page 56)

The Southern Ocean and part of Greater (East) Antarctica, showing the tracks of the *Discovery*, 1929-30 and 1930-31, during the British, Australian and New Zealand Antarctic Research Expedition

Based on the map in the *Geographical Journal* (Mawson, 1932), with some deletions and an added insert

Map drawn by Vera Brice

Published in the Royal Geographical Society

ANTARCTIC REGIONS
Map 1931

> "to glean as much knowledge as possible of a large span of hypothetical coastline of the Antarctic continent and of the coastal waters in the region south of the Indian Ocean and Australia. This region, on account of its geographical situation, is of peculiar interest to New Zealanders, Australians, and South Africans. There now appears to be no doubt that throughout this region, the coast line of a continuous land mass extends in the neighbourhood of the Antarctic Circle".

Whale Fisheries and Mineral Wealth

He foresaw the continent's mineral wealth being tapped in the distant future. Its present wealth was the whale fisheries, in which connection physical oceanography and marine biology would be important subjects to investigate, as well as meteorology, terrestrial magnetism, solar radiation, geology and hydrology. One of the important scientific aims was to continue the oceanographic stations and trawls of the 1925-27 expedition. In this, the expertise of James Marr, seconded by the Discovery Committee, proved of great value.

Finance

The cost of the expeditions was met partly by the Australian and New Zealand governments and partly by private donations, especially those of Mr. MacPherson Robertson, the Australian philanthropist, after whom the expedition's discovery, Mac.Robertson Land, was to be named. The *Discovery* and her Gypsy Moth seaplane (Plate 7) were to make a preliminary survey of a great arc of Antarctic coastline, covering roughly 45°E to 140°E. Formal proclamations annexing most of this area for King George V were made. From the BANZARE expedition resulted the claim to Australian Antarctic Territory, frozen since 1959, like the claims of other nations, by the Antarctic Treaty.

John King Davis

The Master of the *Discovery* (Plate 8), and second-in-command of the expedition, was Captain J.K. Davis, who had been Chief Officer in the *Nimrod* (1907-09) and later Master of the *Aurora* (1911-14) with the Australasian Antarctic Expedition. Mawson put Davis in charge of fitting-out the *Discovery* in London, one of his appointments being the *Discovery*'s Chief Officer K.N. MacKenzie. MacKenzie's diary describes his first sight of the *Discovery* in the summer of 1929, on his return from a voyage in the *City of Valencia*. As this vessel's stern swung round in the main dock basin.

Plate 7

The Gypsy Moth Seaplane

from which new Antarctic land was seen

Plate 8

***Discovery* under sail**

Photograph by Frank Hurley

> "her somewhat sad-hearted second mate, still dreaming on the memory of moon-light nights above the flying bridge, had his trend of thought smashed by the soul-stirring sight of a polar ship" - a "trim little barque with her lofty masts and long cock-billed yards, her squat funnel placed well aft almost hidden behind the network of ropes and rigging and away aloft high on her mast her little lookout barrel", a sight "to banish all soft thoughts and more than enough to quicken the pulse of heart and imagination" with the "spirit of sail, spirit of the sea, spirit of adventure - and there, clearly written in bold letters of brass ... the famous and historical name *Discovery* ... Scott's old ship, again preparing for a voyage to the uncharted and unknown" (MacKenzie, 1929-31).

The *Discovery* was the British Government's contribution to the expedition. She was available because of the construction of *R.R.S. Discovery II*, specially designed for the Discovery Committee's investigations in the Southern Ocean.

The First Southern Voyage, 1929-30

Sir Douglas Mawson, the two pilots and the Australian and New Zealand scientists came aboard at Cape Town in October 1929, when the first southern voyage of the BANZARE expedition began. Survey and scientific work was carried out at the Crozets, Kerguelen and Heard Island. These sub-Antarctic islands have a wealth of wild life. The scientists came into too close contact with this when bulky Sea Elephants pushed into their sleeping quarters on Heard Island. Captain Davis was reported to have found a burrowing petrel in the toe of his sea boot, apparently pleased with its ready-made nest! The new echo-sounding gear worked well while the vessel was under way. This had been pioneered to an extent by Admiralty scientists during her previous voyage.

Nearing Enderby Land, discovered by Captain John Biscoe in 1831, the *Discovery* met heavy pack ice, and a sharp lookout was kept for land. The aviators took off in the seaplane from a pool in the pack and discovered Mac.Robertson Land. Mawson went up in the seaplane and saw a magnificent panorama of new land spread out below him. He transmitted a press report describing the coast-line of rock and fast ice stretching for over one hundred miles. "Striking ranges of black, rocky mountains" and "sharp, protruding peaks" could be seen above the "rising slopes of the continental plateau" (see Savours, 1992. 243).

The *Discovery* was not the only ship exploring these unknown Antarctic coasts. On 14th January 1930, a dramatic meeting took place with the exploring

ship *Norvegia* (Captain Nils Larsen). She had been dispatched by Konsul Lars Christensen (1884-1965), the Norwegian whaling magnate and shipowner, who financed a series of expeditions to the Southern Ocean in the 1920s and 1930s. Besides making a considerable contribution to Antarctic exploration, he was the principal territorial claimant for Norway in the Antarctic. The Commander of the *Norvegia* expedition of 1929-30 was Captain Hjalmar Riiser-Larsen, the air ace and pioneer of Norwegian civil and polar aviation. This unexpected meeting with the *Norvegia,* concerned the discovery of whaling grounds and possible sites for whaling operations in the Antarctic. Riiser-Larsen came aboard the *Discovery,* and the two leaders agreed on longitude 45°E as the boundary between the British and Norwegian activities. Scientific and exploring work continued during the remainder of this first BANZARE voyage of the *Discovery*, which terminated in Adelaide on 1st April 1930. Captain Davis returned to his post as Commonwealth Director of Navigation. Chief Officer MacKenzie replaced him as Master of the *Discovery* for the second BANZARE voyage of 1930-31.

The Second Southern Voyage, 1930-31

Departing from Hobart on 22nd November 1930 and touching at Macquarie Island, the *Discovery* coaled with some difficulty from the first diesel-propelled whale factory ship *Sir James Clark Ross* at the entrance to the Ross Sea. A dead whale acted as fender while the huge vessel towered above the *Discovery,* whose yards were well braced and cockbilled to stay safely alongside. Mawson found the great ship a revelation when he went aboard. Several more whale factory ships and whale catchers were sighted off the coast of Antarctica (Plate 9), one crew member finding these waters "quite as busy as the English Channel!" (see Savours, 1992: 280). Reflecting on the expedition in a press report, Mawson made some interesting remarks about the feverish activity of the many whaling vessels observed in the far south and forecast the decline of the whale - "the most highly taxed creatures on earth" (see Savours, 1992: 289-290).

Sailing and steaming along some hundreds of miles of uncharted Antarctic coast, flying the Gypsy Moth when ice and weather permitted, the *Discovery* anchored at Mawson's old winter quarters of 1911-14 in Commonwealth Bay (Plate 10), discovered Banzare Land from the air and sighted Sabrina Land in poor visibility. Bowman Island was discovered and the remains of Termination Ice Tongue located. New land was discovered and named Princess Elizabeth Land after our present Queen. The Mac.Robertson Land coast was examined and the MacKenzie Sea (now Bay) roughly charted. All the rocks recovered from the sea floor near the coast were found to be continental in character. Together with the

Plate 9

Whale catcher with distended bodies of dead whales

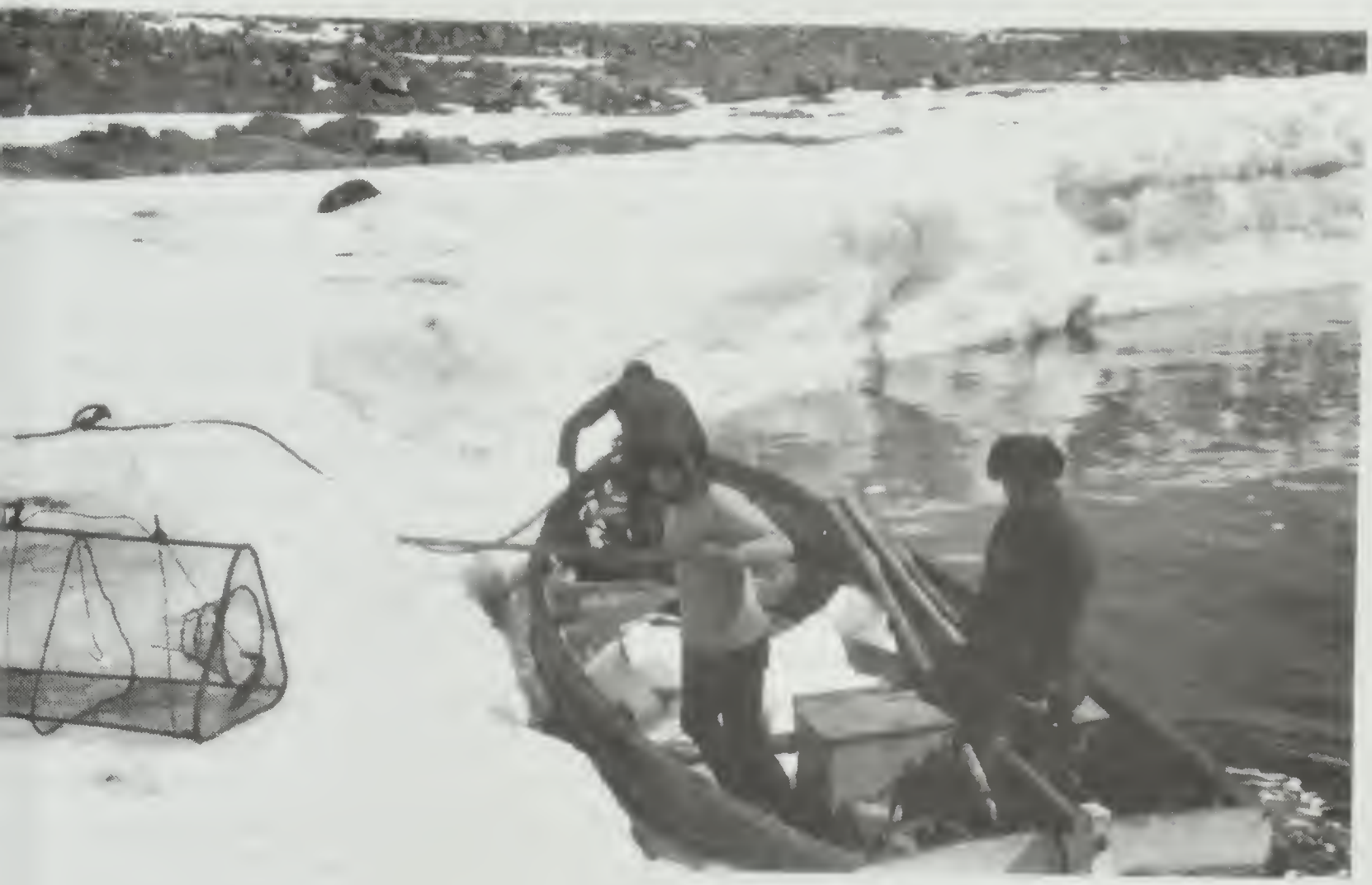


Plate 10

Boat crew at work during BANZARE 1929-31

probably in Commonwealth Bay, Antarctica

geographical discoveries, they demonstrated the existence of an Antarctic continent. A last landing and proclamation was made on 18th February 1931 at Cape Bruce, when the *Discovery* (to the great regret of Mawson and the scientists) steamed north for Hobart, because the coal supply, considered Captain MacKenzie (as did Captain Davis before him), had dwindled to the lowest level which could safely be allowed for the passage home.

Despite the precedence given to the geographical and political aims, a considerable scientific programme was carried out by BANZARE. Professor T. Harvey Johnston of the University of Adelaide, a colleague of Mawson's, directed the biological work and took on responsibility for its publication in the BANZARE Reports. Few landings were made on the continent and then only for less than a day. Nevertheless, enough samples were collected from the rocks of Enderby Land, Mac.Robertson Land and Possession Island for reports on their petrology to be published in the scientific results. The ornithologist, R.A. (later Sir Robert) Falla, was able to demonstrate the extraordinary flight of the Arctic Tern almost from Pole to Pole. Many fine hauls of fish and invertebrates were obtained, and throughout the voyages the distribution of plankton was particularly noted, in relation to the whales and other sea creatures.

Publication

However, Sir Douglas Mawson had great difficulty in finding the finance to publish the expedition results, which appeared between 1937 and 1975. It fell to Sir Archibald Grenfell Price to compile the Geographical Report, after Mawson's death, under the title *The Winning of Australian Antarctica* (Price, 1962) although useful short accounts by Mawson appeared in the *Geographical Journal* on the expedition's return (Mawson, 1932 and 1934). In recent years, the diaries of both Mawson (Jacka and Jacka, 1988) and Captain Davis (Crossley, 1997) have been published, as well as that of the Assistant Biologist, Harold Fletcher (1984).

Summary

A summary of the biological work, its equipment and methods, by Professor T Harvey Johnston was published in the BANZARE Reports, Series B in 1937 (Johnston, 1937). In this report Johnston wrote not only about the richness of the hauls, but also of the long hours entailed in "sorting, labelling, registering, bottling or tubing, and then packing away of specimens", tasks which proved arduous in bad weather, when the *Discovery* was rolling in heavy seas. J R Norman's report on Fishes was published in the same year. She recorded 180 oceanic specimens, of

which two were new to science (Norman, 1937). In 1937 there also appeared R.A. Falla's extensive, well-illustrated report on Birds, which included his observations on the Arctic Tern *Sterna macrura* (Falla, 1937).

Conclusion

The three Antarctic voyages of the *Discovery* made a very considerable contribution to natural history. The old wooden barque, which soon celebrates her centenary, is now berthed in Dundee, a stone's throw from where this conference was held. Here in tribute are Dr. Edward Wilson's words of praise, written after a furious gale with seas "immense as only the South Atlantic can make them" during the homeward voyage in July 1904 (Savours, 1966: 390; Wilson diary entry for 26.7.04).

> "There is nothing made by man more wonderful than a sailing ship and to realise this fully one must spend some hours at night under more sail than appears quite safe in a sou'westerly gale in the roaring forties with squalls of force 10 and 11 by Beaufort's scale. And then, one must spend eight hours bumping and grinding the very soul out of her on the rocks, in the ice and fury of an Antarctic southerly blizzard. One may see her gripped in ice and half buried in snow drift and she waits patiently, one may see her smiling fresh with new paint in the tropics and she looks beautiful, one may have felt her punching her way in the face of head winds when all else fails, by steam, or rolling till she creaks and groans again in a flat calm on a long and heavy swell. She may look obstinate, she may be trying, but wait till you see her tried to the utmost and when she has to bend or break she is like a really perfect human being and she bends double first. Then you can realise how instinct with life and therefore loveable is the work of man, if only he has done his best".

Editorial Note

This paper complements and to some extent overlaps the author's recent detailed book on the voyages of the *Discovery* (Savours, 1992) and also another paper on the *Discovery*'s oceanographic work, given in San Diego to the Fifth International Congress on the History of Oceanography in 1993 (Savours, in press).

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THE DISCOVERY COMMITTEE - MOTIVATION, MEANS AND ACHIEVEMENTS

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Introduction

An earlier contributor to this conference has discussed voyages of the R.R.S. *Discovery* while it was owned by the Discovery Committee. This was largely a joint attempt by scientists to conserve the whale, and by the government departments concerned to preserve the whaling and sealing industries. This present contribution deals with the Discovery Committee itself - its formation, work, difficulties and achievements.

Origins of the Committee

To start, one should consider the careers of a small group of men who steered the Committee from initial ideas on the need for conservation, through to the retirement in 1933 of the first Chairman, E. Rowland Darnley. The key members of the group were born between 1862 and 1876, and so were in their thirties and forties when whaling was started off South Georgia by C.A. Larsen in 1904 (Headland, 1984). That year, William Lamond Allardyce (Heyburn, 1980) became Governor of the Falkland Islands and Henry Gascoyne Maurice, who had read Greats at Oxford, was called to the Bar. Maurice was a keen field naturalist who eventually (1912) became Assistant Secretary in charge of Fisheries at the Ministry of Agriculture and Fisheries, and President of the Council for the Exploration of the Sea (Hindle, 1950). As Governor of the Falkland Islands, Allardyce took the first steps to regulate whaling by introducing 'An Ordinance to Regulate the Whale Fishery' in 1906.

Whaling increased rapidly, leading to the formal definition of the Falkland Island Dependencies by Letters Patent in 1908 (Headland, 1992), the same year in which Darnley became Secretary to the Finance Committee at the Colonial Office Darnley, the same age as Maurice, had read mathematics at Trinity College, Cambridge, where he was fifth wrangler, and then took B Sc with first-class honours at London University. His interest in whaling developed when he became

concerned with Falkland Island affairs. He claimed Scandinavian studies and European travel, particularly in Norway, Sweden and Finland, as his hobbies.

In 1909 the key movements of people which were to lead to the Committee's formation were occurring. In South Georgia (Headland, 1984), James Innes Wilson was appointed as the first Magistrate. Over the next few years he sent reports on the activities of the whaling companies to Allardyce who, in turn, made recommendations to the Colonial Office. In London, Darnley was made a 1st-class Clerk and Sidney Frederic Harmer was appointed Keeper of Zoology in the British Museum (Natural History). Since the Museum had a very large collection of Cetacea, Harmer's interest in them was revived, and he initiated the practice of reporting all stranded whales in the British Isles to the Museum. (His interest dated back to work on a stranded whale on the Norfolk coast in 1893). Harmer had won a mathematics scholarship to University College London, where he obtained a B.Sc. before going to King's College, Cambridge, where he gained first-class honours in both parts of the natural history tripos (Calman, 1951). He became an Assistant Tutor at King's and Superintendent of the Cambridge University Museum of Zoology. Amongst his pupils was John Stanley Gardiner (Forster-Cooper, 1947), who had simulated Maurice's interest in natural history when they were at school (Hindle, 1950). At Cambridge, Gardiner helped to recruit biologists, including Eustace Rolfe Gunther and L. Harrison Matthews, for the *Discovery* Expedition in 1923.

Also in 1909, Sir John Murray wrote to Johan Hjort, the Norwegian Director of Fisheries, asking for the use of the Norwegian fishery ship, the *Michael Sars* (Hardy, 1950). In 1910, while Sir John Murray and Johan Hjort were on the *Michael Sars* investigating the oceanography of the North Atlantic, another Norwegian, Andreas Mørch, sent a memorandum to Harmer which acted as the catalyst that would bring Darnley, Harmer and Maurice together for the first Interdepartmental Committee. Mørch was a Norwegian engineer and inventor who was concerned about the wastefulness of whaling. He suggested that every whale killed should be logged, and that a proportion of whaling dues should be set aside for scientific research (Savours, 1992).

Whaling Licences

By May 1911 Allardyce was receiving conflicting advice, from the British Museum (Natural History) to limit the number of whaling licences issued, and from the Colonial Office "that there was no reason to think that too many are being killed at present". He asked Innes Wilson in South Georgia for facts. At the time

of his appointment, Wilson had visited all the whaling stations on the island. In early 1912 he published a note in the *Geographical Journal* on the coast of South Georgia, in which he detailed the then known areas in a clockwise direction from Cape Nunes to Cooper Island, ending with the sentence "From here to Cape Nunes has been very little examined" (Wilson, 1912). The accompanying map shows the known whaling grounds as indicated by the activities of the whaling companies during the 1909-10 season. In August that year he marked Cape Darnley on a chart accompanying his despatch. It lies in the area previously described as "very little examined" (Hattersley-Smith, 1980). This could be interpreted either as flattery of the boss, or as encouragement to share the interests of the Magistrate and the Governor. At the same time, Allardyce came down firmly in favour of conservation and limiting the actions of the whaling companies. The Colonial Office did not support his suggestions. It was also in 1912 that Murray and Hjort published their joint volume on *The Depths of the Ocean.*

The 'Discovery Set'

In 1913, when the first of three Interdepartmental Committees was created, this group of men had become the nucleus of what I shall call the 'Discovery Set'. The first Committee was chaired by Maurice, and amongst those giving evidence were Allardyce, Harmer and Hjort (a friend of Darnley's). At about the same time as this Committee met, Major G.E.H. Barrett-Hamilton was sent to South Georgia to make early investigations into whales and to collect for the Museum (Headland, 1984). He started the first work on the breeding of whales through the study of signs of pregnancy and lactation in whale carcasses. Most unfortunately, Barrett-Hamilton died in 1914, after only a few weeks in South Georgia, and the formal work of the Committee was stopped at the outbreak of the 1914-18 war.

Planning for another Interdepartmental Committee, undertaken during the war, included the Colonial Office considering using a vessel to study whales and whaling, and consulting R. N. Rudmose Brown who was also concerned about the possible extinction of whales. This second Committee first met in April 1918, electing P.C. Lyon, of the Department of Scientific and Industrial Research, as Chairman. Other members included Darnley, Harmer and J.O. Borley, Superintendent Naturalist Inspector of the Fisheries Division of the Board of Agriculture and Fisheries (nominated by Maurice, since he was too busy to take it on himself), C.V. Smith of the Admiralty, and H.T. Allen of the Colonial Office as Secretary. They took evidence from W.S. Bruce, C.A Larsen and T.E. Salvesen, amongst others (Allen, 1920).

Bruce's evidence led to a recommendation that "Financial assistance should be given to enable the proper authorities to complete Reports of the Scottish National

Antarctic Expedition". Salvesen supported the view that Humpbacked Whales were being overfished. Larsen did not believe in over-fishing. In giving evidence he said:

> "I do not believe it is possible so to deplete the stock of the so-called fin whales so that posterity may be without them. As a rule they sink in a rough sea and then they are difficult to catch" (Allen, 1920).

The 1920 Lyon Committee Report

The Committee's Report, published in 1920, made a number of recommendations, the most fundamental being increasing an existing tax upon whale oil to pay for a research expedition "concerned with the possibilities of economic development in the Dependencies and in particular with the preservation of the whaling industry". These recommendations were the core of the future programme. The Report was commented on by Borley in minutes to Maurice. He thought that "the Chairman showed some signs of being somewhat obsessed by the authority of Dr. Bruce on any matter connected with the Antarctic" and wrote of Harmer, who by then was Director of the British Museum (Natural History), "Dr. Harmer takes a very pronounced view of the dangers to the stock in the present position and after some discussion it was arranged that the more debatable statements should be relegated to the Appendix over Dr. Harmer's own name". He also said "the Report in regard to whales seems to me to have kept to the sound line of saying it is necessary to investigate....".

It should be noticed that the 'engine' driving all these committees was the Discovery Set, eminent individuals with direct personal motivation that scientific research into whales and the whaling industry was needed, and it was the coming together of like-minded individuals in different Departments which led to the Whaling Research Executive Committee. Put another way, the Committee was not the result of initiatives by politicians, but rather that scientific civil servants with common interests were able to promote these interests with no apparent additional costs to the British taxpayer if it was paid for by an extra duty on whale oil produced in the Dependencies largely by Norwegian whaling companies

The Discovery Committee

After publication of the Report and the choice of the *Discovery* for the Expedition, a third Interdepartmental Committee, originally called the Whaling Research Executive Committee, was set up and first met in April 1923. This had a virtually similar membership to the Lyon committee, with Admiral Glennie

replacing Captain Smith and Mr. Wordie, representing the Royal Geographical Society, joining them. Allen joined the committee as the Finance Member. In June they changed their name formally to The Discovery Committee.

The Committee's first meetings were devoted to finding a Captain for the *Discovery*. Then they advertised for a Director of Science. The 1920 Report recommended that "The remuneration of the civilian scientific staff should be provided for at considerably higher rates than have been given in the case of previous expeditions". After eight months of advertising and discussions, during which Harmer had worked behind the scenes to find out whether Stanley W. Kemp could be persuaded to apply for the post and had asked E.J. Allen, on the selection committee, to read and report on Kemp's published work, the choice finally lay between A.C. Hardy, whom the Committee had decided to appoint whether or not he got the Director's job, and Kemp. Kemp was standing out for the high salary of £1,500, whereas Hardy was prepared to accept the advertised sum of £1,000. Allen showed his first disagreement with the Discovery Set by preferring Hardy on grounds of cost, although he also thought that Kemp would be difficult to work with. At that time, Hardy was working under Borley for the Board of Agriculture and Fisheries. Ultimately, Kemp was appointed Director of Science.

Outside Influences

In the course of the Committee's life there were several events and organisations beyond their authority which steered their actions. The first of these was the Falkland Islands' Government. The whaling was done in the Dependencies, the benefits, if any, of the research were to be for the Dependencies, and therefore it was all done in the name of the Falkland Islands Government. Their representative on the Committee, when he was in London, was Sir John Middleton, the Governor of the Falkland Islands. Because of this relationship, the Committee offered J.E. Hamilton, the Colonial Naturalist in the Falkland Islands, an appointment three weeks before appointing Kemp on 27th February 1924. Kemp took up his appointment on 2nd July 1924, by which time E.R. Gunther, Dr. H. Marshall, H.F.P. Herdman, N.A. Mackintosh, J.F.G Wheeler and L. Harrison Matthews had been appointed, in that order.

Plan of Work for the Expedition

By 16th March 1924 Kemp had produced a General Plan of Work for the *Discovery* Expedition Here the difficulties of matching personnel to working

areas, biological seasons and the Antarctic winter were first discussed, together with a suggestion of work in and around South Africa. In February 1925, after seven months' work in London, Kemp's Note on the Scientific Work to be Undertaken by the *Discovery* was printed (1). This was his detailed interpretation of the programme, but only for those on board the *Discovery*. His guiding principle was to take a broad approach to the work, investigating everything which might have relevance as suggested by the Lyon Committee. His standpoint was shown in the sentence "But it is evident that no hard and fast line can be drawn between economic and purely scientific results, for data which seem at the time to have little economic value may subsequently be found to possess great importance from this point of view" (1). On several later occasions, this argument, a basic scientific concept, was used as a defence of their work .

It was initially anticipated that the Expedition would last three years and would employ three different groups of scientists. The first group to start work were at the Marine Station at Grytviken. This was a base for anatomical and physiological studies of whales, and later for much chemical analysis of water samples. The second group of scientists were those on board the *Discovery*. The third group to start work were on the Committee's second ship, the Research Steam Ship *William Scoresby* (Plate 1).

The *William Scoresby* was designed for two main purposes, the marking of whales, which was Harmer's first priority, and for trawling surveys in the hope of finding an area for an economic fishing industry. After Kemp had persuaded the Committee of the need to motivate the scientists by enabling them to write up their work and for it to be published, a fourth area of work, in the British Museum (Natural History), was arranged. (In 1919 Rudmose Brown had recommended that this be based in a laboratory of one of the Scottish Universities, because of their specialisation in marine biology and Scotland's interest in whaling, past and present, in all east coast towns).

Committee Structure

Darnley and Harmer were respectively Chairman and Vice-Chairman of the Committee. Harmer was also Chairman of the scientific sub-committee which provided backing and expert knowledge, in so far as any existed, on whales for the Director of Science. Another sub-committee was the ship sub-committee, which was chaired by the Admiralty representative. It is hard not to wonder whether the Admiralty was satisfied to act as a supporting service, with half the executive control as recommended by the Lyon Committee. The ship sub-committee seems not to have worked well with the scientists and was sometimes unprepared for the

Plate 1

The *William Scoresby*

Grytviken, 10th April 1931

(Photograph by courtesy of Southampton Oceanography Centre)

demands made by them. Admirals Glennie, Nares, and Douglas (from 1928 to 1932) were Chairmen. Douglas, a year younger than Darnley and Maurice, had been in command of the *Waterwitch*, surveying the Malacca Straits in 1908 where he developed the Douglas-Schafer sounding gear, and by 1924 had become Hydrographer to the Navy. His past experience led him to be an enthusiastic supporter of echo-sounding, and its general adoption is attributed to him. He should have fitted in as a member of the Discovery Set, but he was the first to suggest that the work at sea be discontinued since the early work had not produced definite results.

The *William Scoresby*

The ship sub-committee was responsible for the construction of the *William Scoresby,* built in Yorkshire. Initial instructions for her specifications were being requested in February 1924, but she didn't leave Hull until June 1926. There were innumerable delays in the ship's construction, and the builders incurred a loss of nearly £5,000. In July 1926 the Crown Agents recommended an extra payment of £3,000, since if the contractors went into liquidation it would lead to difficulties with the sub-contractors.

Discovery II

Sanction for the building of the *Discovery II* came in February 1929. She was built at Port Glasgow and sailed on her first commission in December 1929 (Rice, 1986). The *Discovery II* (Plate 2) was a luxurious research ship compared to the *William Scoresby*. Years later the Crown Agents' representative on the ship sub-committee said that the *William Scoresby* always gave trouble. It could be argued that much of the trouble was induced by lack of the loving care which was lavished on the *Discovery II*. The *William Scoresby* suffered inferior treatment.

First Whaling Factory Ship

The first pelagic floating whaling factory, the Norwegian *Lancing,* set off south in June 1924, several months ahead of the *Discovery*. On 24th February 1926, four days after the *Discovery* reached South Georgia, the Committee prophetically recorded:

> "If the practice of whaling in this form increased it might easily diminish the number of whales so far as seriously to injure or even destroy the whaling industry, and consequently the Government Revenues derived from it The practical value of the Discovery Expedition might also be considerably reduced" (2).

Plate 2

The *Discovery II*

Deception Island, 25th December 1930

(Photograph by courtesy of Southampton Oceanography Centre)

Attitude of Falkland Islanders

A problem which caused much turmoil at the time, but little long-term damage, was the attitude of the Falkland Islanders to the Committee. They saw the whale-oil revenues as resources for the colony's development and sought instant obvious economic benefits, not pure scientific research. In July 1927 H.H.R. Gresham, the manager of the Falklands Islands Company in Stanley, wrote declaring the expedition to be prodigal waste of money:

> (a) "that is wrong in principle that Revenue should pour direct into the hands of a scientific or any other body and be administered by them and
>
> (b) that whilst the movement of plankton and the collection of specimens may be of interest to scientists it is of no economic value to the colony. The outstanding fact is that whales are either in the vicinity of South Georgia ... where they can be caught or they are not there" (3).

The Governor, Arnold Hodson, forwarded this letter to the Secretary of State for the Colonies. Six months later he replied that the Colonial Office found it "impossible to accept that taxation imposed on the Dependencies for particular purposes should now be directed to swelling the already surplus balances of the Falkland Islands ..." (4) and much more along these lines.

Committee Differences

In spite of the similar aims of the 'Discovery Set', cracks occasionally appeared in their unanimity. In early 1928, soon after the Gresham affair, H.T. Allen put forward a proposal for a special post, to be filled by Borley as a full-time member of the Committee. Borley said that in his opinion "the task of preparing economic work for discussion and the need of some supervision of the junior scientific staff at home made such an appointment imperative" (5). This manoeuvre was arranged without telling Harmer, and it also appeared to ignore the fact that Kemp was then based in London . (Harrison Matthews left the employ of the Committee as soon as his first leave was over, and Hardy had just accepted an appointment in Hull) Kemp interpreted this as the appointment of an overboss, and submitted his resignation, but was later persuaded to continue. It did appear to show a lack of trust in Kemp, and Borley's wish to emphasise economic results was an example of the historic difference between fisheries/economic and basic marine research, described by both Mills and Deacon, which Kemp was so keen to unite. Once Borley had taken up his position, Maurice joined the Committee. A significant

difference of attitude was shown in discussion about the proposed new ship, *Discovery II*. Wordie considered work ashore to be more valuable than work aboard ship, promoted the idea of establishing another shore station in the South Shetland Islands, and deferring a new ship. It was here that Wordie revealed his interest in exploration and possible expansion of the whaling industry, rather than scientific research.

Harmer's contribution to the natural history work of the Committee was dominated by his interest in Cetacea, and most particularly their migrations. He was convinced that if whales were 'tagged' with small numbered darts, which were to be returned to the Museum after the whale was slaughtered, it could be determined whether the whalers around Africa and in the Antarctic were catching from the same population, and so make an estimate of the population. This work and his interest in it has been written up in several places, but it is appropriate to see it within the totality of the Discovery Committee's work and Harmer's role within that.

Whale Marking

The first marks resembled large studs or drawing-pins attached to the end of a wooden arrow. Hardy gives an account of testing these with Hjort from the *Michael Sars* (Hardy, 1967). In April 1930 Kemp, writing from South Africa to Dilwyn John (one of the biologists then working in the London office), said "I am afraid whale marking by present methods is rather a wash out" (6). Harmer and Kemp, however, both had faith in the actual principle. The studs were replaced, first by aluminium and then by 'Staybrite steel' marks (Plate 3). By 1934 only two marks had been returned, which represented less that 1.0% of those used.

There was a temporary cessation of whale marking. In 1935 Wordie felt that the increase in whaling was so great that a crisis in the industry would occur in the near future, and that the Committee should be ready with marking results by then The Committee had lost an opportunity to advise at the time of the Geneva Convention in 1930, and they should be ready to advise, on the basis of convincing figures, and should not lose a similar opportunity when it next came. Kemp said that he would not oppose a resumption of marking, but he must make it clear that he was not over-confident of the results. Of the 4,988 whales marked in the Antarctic before 1939, 3.8% had been recovered by 1939 and 7.9% by 1975 (Brown, 1977).

Plate 3

Whale Marks

Increase in Pelagic Whaling

The rapid increase of pelagic whaling did lead to a world glut in 1929-30, a development which caused a drop in the price of whale oil and so also the amount of revenue available to the Committee (Tønnessen and Johnsen, 1982). Consul Lars Christiansen, a Norwegian whaler and ship owner, professed interest in scientific research on whaling and the need for conservation, but he also aimed to expand the industry. He built the *Norvegia* as a 'research' vessel. Between 1927 and 1933 she sought new whaling grounds throughout the Southern Ocean, including a circumnavigation of Antarctica, and in January 1930 *Norvegia* met Mawson on *Discovery,* then on the BANZARE expedition (Savours, 1992).

Work in the Pacific Ocean

On 6th May 1930 Mawson sent a report to the Committee saying that he had "found millions of pounds worth of product that the discovery [of] alone is worth far more than all the cost of our exploring expedition" (7). It was suggested to Kemp that their work be extended to the Pacific. On 3rd July Kemp wrote to Dilwyn John that he felt that a reserve "was vitally important ... but the really important thing is not to send us off inspecting distant areas unless there is a good certainty that a reserve will be created" (8). The plans for the *Norvegia's* circumnavigation reached the Committee on 30th July 1930. Harmer sent Darnley a draft "Warning about the future of the growth of Antarctic whaling on the Future of the Whaling Industry" (9) At Darnley's request on 23rd August this was followed up by a longer "Confidential note on measures designed for the Preservation of the Whaling Industry". He recommended reserves probably "along the ice edge and in its vicinity in that portion of the Antarctic bordering on the Pacific Ocean" (10). The second commission of *Discovery II*, during 1931-33, included the first winter circumnavigation of Antarctica, and all subsequent commissions took them to the Pacific (Figure 1).

Waning Influence of the 'Discovery Set'

In 1933 the influence of the 'Discovery Set' as the power behind the Expedition began to weaken. Harmer was then 70 years old. As shore-based whaling had diminished, the Under-Secretary of State noted that the income of the Research and Development Fund was declining and that further commissions of either ship might not be possible. The Committee was advised that it could no longer count on the special fund for Research and Development in the Dependencies of the

Falkland Islands, which might be allocated to other purposes not connected with the Falkland Islands.

After interviews with the Secretary of State and a personal appeal by Harmer to the Prime Minister, Mr. Baldwin, the Secretary of State agreed to the recommissioning of the *Discovery II* for a third and final commission. Because of unforeseen interruptions, permission was eventually given for a fourth, and then a fifth commission. There was also a sixth commission after the second world war under the National Institute of Oceanography (1950-51). At the end of 1933 Darnley retired from the Chairmanship. The Committee commented on "his effective services to the control of whaling in the Dependencies and his efforts towards securing International regulation of whaling" and "his ability to read the Norwegian language" (11).

New Committee Structure

The second Chairman was the Earl of Plymouth. His first action was to sound out whether the other members wished Darnley to continue as a Committee member. Perhaps it was phrased as a question expecting the answer 'no'. At any rate that was the answer he received. During the previous decade the Committee had grown considerably in size and the balance of power had shifted. Vice-Admiral Sir Percy Douglas had stayed on the Committee after his official time had ended. Sir John Middleton, although no longer Governor of the Falkland Islands, had become a permanent member. The Crown Agents were frequently represented by their Shipping Officer E.A. Nattriss. Significantly, all subsequent Chairmen were politicians. Kemp, together with the scientific sub-committee, planned the work that was to be done by each ship or shore site while the ship sub-committee supervised the ships and their staffing. Communications were poor, because of the long distances, because of poor technology, and occasionally because of plain secrecy (or possibly even deliberate obstruction) which with hindsight appears unjustified. Kemp reported that one of his most difficult jobs was the allocation of staff. He repeatedly had to alter the programme, because the ships were not ready in time to reach the work area at the necessary season, or that staff were not in the right place at the right time.

Interference and Lack of Coordination

On some occasions the Committee, in its wisdom, required the ships to be in inappropriate places - usually as a result of outside influences, but not always. The first of these was when Sir Hubert Wilkins, an Australian/American journalist with a taste for a frenetic life-style of adventure, asked the Colonial Office for £10,000

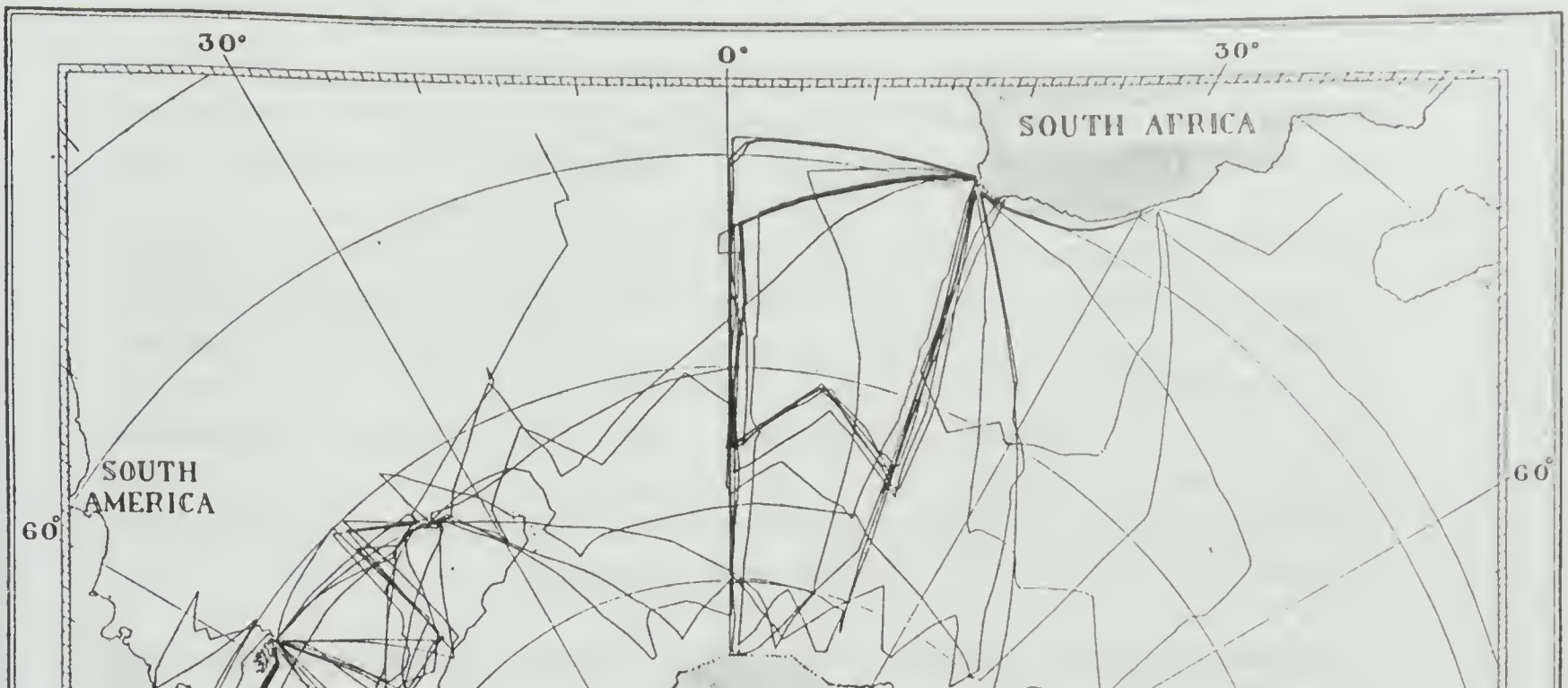

Figure 1

Track Chart of *Discovery II*

1932-1939

(Chart by courtesy of Southampton Oceanography Centre)

and for the *William Scoresby* to be on standby from November to the end of December 1929. Kemp was told that the *Scoresby* would only be required for a few days. (Kemp estimated two weeks). Wilkins loaded his equipment, which included an aeroplane and an Austin Seven motor car, onto the *Scoresby* at Deception Island and sailed south on 9th December. Except for a refuelling voyage to Stanley and Grytviken, Wilkins monopolised the *Scoresby* for two months. The intended scientific programme for the season had to be abandoned. The Committee received no scientific report from Wilkins who, when asked for one, said he had promised all publishing rights to the American Geographical Society. He wrote claiming that a copy was enclosed; it got lost in transit. The file moved round the office for months before a minute reached Darnley asking "May the matter now drop?" His reply was "Yes at once".

During the third commission of the *William Scoresby,* D.J. Matthews at the Admiralty suggested, via Sir Percy Douglas, to the Committee that the *Scoresby* should survey the Humboldt current off the coast of Peru (Marsden, in press). After some discussion trying to justify spending Falklands' money in the Pacific, Kemp was virtually commanded to add a whole new stretch of ocean to the programme. Since the staffing had not been arranged for this, Gunther and Laurie, both zoologists, carried out a hydrographic survey.

Scientists and Captains

From Captain Cook's time onwards there have been difficulties in reconciling the needs of Senior Scientific Officers and ship's Captains. Either the Committee doesn't seem to have been very skilled in its selection procedures for Captains, or else the field to choose from was poor. On one occasion the Committee deliberately went against Kemp's advice about an appointment. A few quotes support this:

> Of Captain A by Captain B: "is terrified of ice and usually stops in his bunk until hooked out for an emergency" (12).
>
> Of Captain C by a senior scientist: "He has no hold on what is happening" (13).
>
> Of Captain D by a senior scientist: "None of ship's movements, after leaving Stanley planned by me but taken in hand by Captain who has told me nothing and from hour to hour I am in ignorance of what he will do next He changes his mind so often that it seems useless continually to be asking what next" (14).

> By a member of the ship sub-committee: "I have yet to learn that the scientists know more about shipping matters than people who have been trained as shipping men" (15).

These attitudes frequently affected the ship's programmes and therefore the scientific work. The *William Scoresby* had five Captains in three commissions, four of whom left involuntarily.

The *Discovery Reports*

It was Kemp's original wish that the scientists should write up their own work. However there was such a wide range of specimens that, when the expedition returned, many specimens were distributed amongst outside specialists. As work was completed the results were usually published in a series of large volumes, the *Discovery Reports*. Their format, designed to be similar to the *Challenger Reports,* makes them unwieldy. Dilwyn John maintained that "those who turned to them would be scholars and undeterred by size" (16), but they did little to explain the work of the Committee to its critics. Some of the blame is usually put on Kemp's dislike of publicity. He was certainly not in favour of what is now called the cult of personality, but the Committee should really be held to blame for the lack of publicity. Dr. Marshall, the doctor on board *Discovery*, gave a children's lecture to the Royal Geographical Society. This was considered to be the cause of Norwegian press reports that the Discovery Committee was undertaking a campaign against whaling. The Committee then required that all outside lectures were to be vetted, and all photographs were to be the property of the Committee. At the same time, Darnley wrote to Harmer that it was "undesirable for the committee as a Committee to seek to place any restrictions on the public utterance of its members". The Committee was reluctant to get involved with the press or to allow its staff to do so.

In 1930 Kemp attempted to get the Committee to create public awareness, yet it was seven years before they produced a booklet on the Investigations (Anon., 1937). Three books about the Expedition were published by staff (or ex-staff) before 1939. The first of these was *Notes and Sketches* by Gunther (1928), but it was only approved by Kemp when special emphasis was made that it was written for a preparatory school magazine. The second, by an ex-cadet, Francis Pease (1935), was classified as biography; it would perhaps have been more appropriate to classify it as biography with imagination. Ommaney's *South Latitude* (1938) was rejected by the Committee on first submission. Later, another three books were published, by ex-staff (Saunders, 1950; Hardy, 1967) and a journalist (Coleman-Cooke, 1963).

Committee Recommendations

It is worth considering some of the recommendations of the Lyon Committee, and how far these were achieved. The Committee recommended:

Management and Control: To be in the hands of the Admiralty and Colonial Office, together with an Advisory Committee. The Discovery Committee was more autonomous than an Advisory Committee, almost an early quango, responsible to the Colonial Office. It was probably this that so annoyed Allen when the Committee made decisions which were independent of the Colonial Office. On one occasion, Borley was reminded by Harmer that the best person to make decisions was the scientist on the spot and not someone in London.

Research Vessels: The recommendation was for two ships to work in concert. Once the *Discovery* had returned to England, the ships worked independently since their abilities were so different.

Botany: In the summary of the Lyon Report's recommendation, botany was dismissed in one sentence. One paper on lichens was produced. What were called "vegetable organisms in the sea" were dealt with under hydrography.

Hydrography: In the summary it took five lines. The main text, with an appendix by G. Herbert Fowler, stated that the importance of plankton work was considered, as well as work on hydrology and hydrography.

Surveyor: Fowler stressed the importance of an Admiralty surveyor. To that end Commander J.H. Chaplin was appointed. He surveyed the coasts of South Georgia and the South Shetlands Islands. When reading the minutes, his work seems peripheral to the main line. His reports read like those of a lonely man, not particularly well supported, and the Committee heaved a metaphorical sigh of relief when his work ended. His work completed the surveying of the South Georgia coast which Innes Wilson had initiated.

Echo-sounding: All three of the Committee's ships were equipped with echo-sounding gear, on the suggestion of D.J. Matthews. The experimental model on *Discovery* was removed in 1926. The *William Scoresby*'s Lucas type was out of action throughout the Wilkins expedition, and by 1932 Commander Carey on *Discovery II* commented that "it would be a very good reason to recommend ships using these waters where the weather is thick, to supply themselves with a Deep Echo machine were it not for the amount of work which had to be done by the ship's staff to make it efficient since its overhaul by the makers in London" (17). An automatic deep-water set installed in 1933 was not effective until 1934. A

supersonic shallow-water set was installed in 1936, and managed to do 120 hours of continuous recording.

Publications and Some Problems

H.H.R. Gresham, of the Falklands Islands Company, criticised the work on plankton. Fifty-seven of the reports are on plankton and invertebrates, and Hardy and Gunther collected plankton from early 1926. Back in London, with an enormous number of samples to be analysed, Gunther spent three years counting and sorting. Kemp grew very dissatisfied at the rate of progress, and, exasperated, said that at Gunther's rate of progress it wouldn't be completed until 1954, so in 1930 Gunther was taken off the work and sent south for two years. The work on the plankton of the South Georgia whaling grounds was published in 1935 (Hardy and Gunther, 1935). They had a lengthy argument by correspondence about this volume. Gunther, disagreeing with Hardy, complained that the hypothesis of animal exclusion should not be publicised until after publication of their paper. His notes say "and recommend that you don't explain the data by your principle. That is putting the cart before the horse. But you show how the data supports the principle" (18). Hardy's hypothesis "died of neglect in the 1940s" (Mills, 1989). J.W.S. Marr was a scientist orginally appointed to take charge of the collections in the British Museum (Natural History). He was seconded to the BANZARE expedition and later produced a large report on *Euphausia superba* (krill).

During the 1930s the emphasis of the work changed from biological whale research to hydrological work. Work on currents identified by Fowler as likely to be important led to major oceanographical papers. The charting of the Peru Current, the Antarctic Convergence, and Deacon's work on the Southern Ocean went far beyond what was anticipated in the Lyon Report (Deacon, 1948).

Under the heading geology and mineralogy. the Lyon Report recommended that a geologist should be attached to the expedition, at any rate for a limited period. There was no geologist attached to the expedition, and rock specimens brought home were examined by other specialists. The Scotia Arc was named on Wordie's suggestion. Hardy's Appendix to *Great Waters,* A Guide to Discovery Reports, the most easily accessible list of the reports, lumps geography and geology together (Hardy, 1967).

The Lyon Report considered fish, penguins and other animals under one heading. It suggested locating profitable fisheries, noting the stock of penguins, encouraging Reindeer on South Georgia, and exterminating the Brown Rat if at all

possible. The Brown Rat still gives problems. The wish to develop a fishing industry in the Falkland Islands led to three trawling surveys on the Patagonian continental shelf by the *William Scoresby*. A copy of the findings of the first survey was sent to the Imperial Economic Committee in July 1928, by Darnley, with the intimation that it was not desired that any publicity be given to the details. This is characteristic of the secrecy of the Committee. Kemp was in some way dissatisfied with a 1928 survey, and wanted Mackintosh and Gunther to repeat it in 1930. The *William Scoresby* was so delayed that the survey had to be cancelled and done in 1931. The combined results were not published until 1946 (Discovery Reports, Vol. 23), and did not seem to have reached the director of one Falklands fishing company by 1990.

Harrison Matthews' account of the birds of South Georgia was the first scientific report ready for publication. Along with the section on Blue and Fin Whales, by N.A. Mackintosh and J.F.G. Wheeler, it appeared in the first volume of *Discovery Reports*, published in 1929.

Sealing and whaling industries had both been practised in the Dependencies. The Lyon Report suggested seal farming, as successfully practised in the Pribilofs, together with a study of seal life history. Two reports were produced by J.E. Hamilton, one on the Southern Sea Lion and the other on the Leopard Seal, and Harrison Matthews produced a report on the natural history of the Elephant Seal.

Salaries

The Lyon Committee suggested that the scientists be well paid, and initially they were. At appointment in 1924 Gunther, a young zoologist direct from Cambridge, had a salary of £500 (19), but by 1925 D.D. John and F.C. Fraser, appointed originally to the *William Scoresby,* received £400 (20). G.E.R. Deacon received only £350 in 1927 (21), by which time all the previous staff had received at least 10% increases (22). When Kemp left to become Director of the Marine Biological Association at Plymouth, Mackintosh replaced him as Director of Science for £1,200.

Conclusion

The whaling industry was the prime reason for all the research. The germs of failure to conserve the whale and the industry were there before the *Discovery* left Dartmouth. It was, in part, the whale-oil duties which encouraged the technical development of pelagic whaling. It was international politics which finally undid the primary objectives of Mørch, Rudmose Brown and Harmer, but without their

alliance with the politicians, the scientists would not have produced such an excellent body of work.

Acknowledgements

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SOME NOTES ON THE DEVELOPMENT OF CETOLOGY, POPULAR INTEREST IN THE WHALE TRIBE, AND A FAMOUS LITERARY WHALE

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Introduction

During the first half of the nineteenth century and particularly in the 1830s the whale tribe became a focus of attention, both among specialist groups of the intelligentsia and the public at large. The knowledge and images of the whale circulated at this period became widely disseminated, and formed the basis of an expanding popular interest in the whale and a major step in the evolution of cetology.

Aristotle in the fourth century before Christ knew that whales and dolphins were air-breathing animals, but later classical authors, such as Pliny (1) and Ovid, more typically confused these aquatic mammals with fish. Writers of the sixteenth century, such as Belon (2) and Rondelet (3), also described whales, dolphins and porpoises under the category of fish. Rondelet, however, governing physician of Montpelier, had dissected a female dolphin and records the fact that they could be transported alive considerable distances from the sea. Dolphins and porpoises were widely traded as items of food throughout Europe, and Rondelet tells us that they were sometimes carried from the coast of Languedoc to Lyons, at least 130 miles, while occasionally a little wine was trickled into the spiracle! Presumably these animals must have been wrapped in wet cloths too, but this is not mentioned.

In 1654 Bartholinus (4) made a detailed dissection of a porpoise in the presence of King Frederick III of Denmark, and our own John Ray published an account of his dissection of a porpoise in the *Philosophical Transactions* of 1671 (5). A few years later, in 1675, saw the appearance of Friderich Martens' account of a whaling voyage to the northern whale fishery at Spitsbergen. A barber-surgeon of Hamburg, he gives us the first substantive eyewitness account of the great whales in their natural environment (6).

Stranded whales have been made use of by man since prehistoric times and were a significant windfall for isolated coastal communities. The beached

cetaceans provided meat for food, oil for lamp fuel, and the bones were used for a variety of practical purposes. At the Neolithic settlement of Skara Brae in Orkney whale jaws were used as roof supports for some of the huts. Vertebrae were hollowed to make bowls and basins, and they were frequently used as seats or chopping blocks over many centuries. The 8th century Franks casket is made of a series of rectangular plaques cut from the jawbone of whale stranded on the Northumberland coast, and is decorated with a celebrated mixture of classical and biblical subjects.

Sibbald and Hunter

Robert Sibbald, President of the Royal College of Physicians of Edinburgh and the first Professor of Medicine at Edinburgh University, published (in 1692) an account of the various whales stranded on the shores of Scotland, which added materially to our corpus of knowledge of the variety of whales and their general anatomy (7). It is not until 1787, nearly a hundred years later, that we have in print the survey by John Hunter of the comparative anatomy of whales, porpoises and dolphins, which shows a masterly grasp of the essential features of the whale tribe and includes a discussion of the development of baleen (8).

Scoresby

Most of the accumulating and increasingly detailed information, however, was restricted to a handful of learned doctors and anatomists, although with the contribution of William Scoresby in the early nineteenth century, knowledge of the great whales and their smaller kin began to percolate to the wider intelligentsia. Scoresby, the son of a whaling captain and himself to become an experienced whaler, was unique among the ranks of whaling masters in having the inclination, and making the time, to attend classes at University. He was at Edinburgh in 1806, aged 17, where he studied chemistry and natural philosophy.

In 1810 Scoresby became a member of the Wernerian Society and some of his journals of voyages to the Greenland fishery were exposed to the study of his fellows for discussion. The following year he wrote a description of the Greenland Right Whale which was published in the Society's journal (9) and Scoresby also became a regular correspondent of Sir Joseph Banks who encouraged his interest in the natural phenomena and natural history of the polar regions. He not only made detailed geographical and meteorological records but also had a life-long interest in magnetism, and in his latter years almost beat Faraday to an undertstanding of the nature of electromagnetic induction. Scoresby's scientific approach was also directed to the business of whaling, and in 1819 the ship *Baffin*

was constructed, based on the experience of his father and himself, and designed throughout specifically for the prosecution of the Greenland fishery. Most whaleships were converted merchantmen, though in Hull a general type was established of a kind suitable for working northern waters, whether in the Arctic or the Baltic.

In 1820 Scoresby published the two-volume work which laid the foundations of Arctic science, *An Account of the Arctic Regions* (10). The first volume is a record of his scientific observations in northern waters and the wildlife to be found there, whales, fish and birds, and the second volume is a history of the whaling trade from the sixteenth century, followed by details of the equipment and methods employed by him and his contemporaries.

His account of the Greenland Whale and other species was less concerned with internal anatomy, and more with the habits and life cycle of the cetaceans he had observed, their feeding, mating, care of the young etc. Pilot Whales, Belugas, Narwhals and Rorquals are all described, and his illustration of the Greenland Whale became accepted as the most reliable image until the investigations of modern scientific observers with their cameras and ability to swim beneath the water with the whale. Some particularly good early drawings of the great whales had, however, appeared even in the eighteenth century, in various editions of Zorgdrager (11).

Public Awareness

As well as the various illustrated books dealing with 'fishes' or describing the whaling trade, individual 'portaits' began to be made of stranded whales. This was a tradition established in the Netherlands in the sixteenth century, where it became the custom for the local prince or magnate to commission an engraving of these notable events which attracted so much public attention. These prints usually show people of all levels of society, and often demonstrate the business instincts of local traders who set up stalls to sell food, refreshments, and probably souvenirs (Plate 1). A pilot whale at Zandvoort on 21st November 1594 (12) was perhaps the earliest subject of these pictorial records, and the drawing by Goltzius of the spermaceti whale at Katwijk in 1598 became a pattern for such prints (13). Similar strandings in Britain might be recorded in diaries and journals, and occasionally on broadsheets, but not with such magnificent illustrations. A broadsheet records a 'prodigious' whale at Blyth Sand in 1672 (14) and a Sperm Whale was similarly recorded from Cramond near Edinburgh in 1701 (15, p. 207).

It was not until the nineteenth century in Britain that we have a print in some way comparable to the Dutch old-master prints of the 16th and 17th centuries. A

Plate 1

A Sperm Whale washed ashore on the Dutch coast
at Beuer, 13th January 1610.

An engraving after a drawing by Jan Sanredam.

The artist, in a cloak with his back to the viewer, can be seen in the left foreground.

portrait of the Sperm Whale washed ashore on the east Yorkshire coast in 1825 (Plate 2) was commissioned by Sir Clifford Constable, Bt., Lord Paramount of the Seignory of Holderness, though it nowhere near matches the artistic excellence of its Dutch antecedents. The keen interest in these frequently huge cetaceans washed ashore on the coast of the Low Countries was, in part at least, encouraged by the nation's involvement in the Arctic fishery which the Dutch whalers dominated in the sixteenth and seventeenth centuries. Here was the opportunity for both the ordinary citizens, and the merchants and nobles who financed the trade, to see animals, if not of the same species, at least of the same tribe and of a similar size which normally only the whalemen themselves would see. It may be noted that Sir Clifford's whale was also stranded at a time when the Hull whaling trade was a major enterprise, indeed the dominant component of Britain's contribution to the northern fishery. The Arctic fishery was largely the preserve of the English, and later the Scottish, whalers, from the eighteenth and throughout much of the nineteenth century (16).

The Burton Constable Whale

Dolphins, Porpoises and the Lesser Rorqual are among the commonest species to be stranded in Europe, and have frequently been found along the Yorkshire coast and within the Humber estuary. Larger species have also swum into the Humber, including a very large example (101 feet in length) which came ashore in 1750 and from its dimensions, if accurately reported, can only have been a Blue Whale (17). Though there was considerable curiosity, and the public might turn out in their hundreds to marvel at these creatures of the deep, they did not necessarily attract the attention of local naturalists or those with a scientific bent (18). This cannot be said of the Sperm Whale washed ashore at Tunstall on the Holderness coast in 1825, which not only found a place in the scientific record but in the pages of a nineteenth century literary classic.

Earliest Accounts

The first report of this whale appears in the *Hull Advertiser* for Friday 6th May 1825, recording that it had been beached on the previous Friday after floating off-shore for some time.

> "The naturalists of this neighbourhood, may now have the gratification of seeing an animal, which it very rarely falls to the lot of the landsman to have an opportunity of witnessing namely a whale of extraordinary magnitude. This enormous creature was thrown on the beach on Friday morning last, about

three quarters of a mile to the north of Tunstall in Holderness, where it now lies, the property of the Lord of the Manor. We are quite at a loss to account for its appearance here, as it is an inhabitant of the southern seas, being the Physeter Macrocephalus or Spermaceti Whale [19]. It was observed floating in the sea, previous to its coming on shore, and was followed for some time by two fishermen, who, supposing it to have been alive, appear to have been afraid to approach it and consequently gave up the chase. Its length is about sixty feet. The head is of enormous magnitude constituting nearly half of the whole animal. The lower jaw is of very peculiar structure, and has no proportion whatever to the upper part of the head being about ten feet long, nearly cylindrical, and of about 18 inches diameter; the upper surface contains 47 teeth, the parts of which protrude above the gums much resemble in size and shape half a gooses egg.

We have not an opportunity of examining the upper part of the mouth, but we understand that the jaw contains no teeth, but simple cavities for the insertion of those of the lower jaw. The front of the head is very abrupt, presenting nearly a perpendicular surface; the spiracle or blow hole is situated on the top nearly at the tip of the nose. The eyes are remarkably small, the surface being not much larger than those of a bullock; the shape of the eye (which we had the opportunity of seeing removed from the head) in particular, being nearly in the form of a truncated cone. The ears are extremely small [20]. It has three fins, two pectoral, and one dorsal [21], which are very small, and can be of very little service in swimming, except in balancing the body. The tail is divided into two lobes and lies horizontally. It measures about 14 feet across and appears to be the chief instrument of motion. The substance called spermacti lies in cavities in the head, we had the gratification to see one opened which produced about 18 gallons. It was perfectly fluid and limpid, having much the appearance of clear olive oil, but immediately on its being exposed to the air, it began to congeal, and in a short time became opake [*sic*] and solid. It is a remarkable circumstance, that though the flesh of the animal indicated no higher temperature than that of the surrounding air (56°), that of the spermaceti when flowing was upwards of 80°, whether this high temperature was the remains of animal heat, or was produced by putrescent fermentation, we cannot determine. The well known perfume, called ambergris [22], is found in this species of whale; it is lodged in the intestinal canal, and is supposed to be the faeces when in a deceased state. It is not known whether this animal contains any of this valuable matter, as the body has not yet been opened. The animal is surrounded by fat or blubber, from six to ten inches in depth, from this the sperm oil is produced. The colour has

been black, but the greatest part of the cuticle, or upper skin, has been washed off, it is perfectly smooth and much resembles Indian rubber.

A great number of visitors, from all quarters, have repaired to the spot; it was calculated that not less than a thousand spectators were present in the course of Sunday. We are informed that two whales, of equal dimensions, were formerly thrown on the same coast - one at Kilnsea, about 53 years ago, and the other at Tunstall, about a mile and a half from the present place about 78 years since" [23].

This is a well informed and intelligent description by someone present during the early stages of exploration and dissection of the carcase. Unfortunately the animal had been dead for a number of days and the state of decay hindered the investigation, as a report a week later makes clear:

"....the dissection of this stupendous animal was far from complete, and far from satisfactory to the scientific gentlemen [24] who took so much interest investigating its structure. This was partly from the fact that it had been three or four days on the beach before the event was generally known in Hull, whereby time was lost; partly from the novelty of the event itself (such an opportunity of examining anatomically one of these monsters of the deep being entirely new to the whole medical profession in this neighbourhood), and partly from the enormous mass of matter of which it was composed, which required to be removed with greater care than was used, so that a complete view could not be taken of its vascular structure and internal economy" (25).

The same writer tells us that the heart weighed 171 lb and the diameter of the aorta was 1.0 foot 1/6 in. No ambergris was found in the gut, but a bucket-full of cuttle-fish beaks was taken from the stomach.

The *Hull Advertiser* (26) tells us that the whale had beached on a Friday, 29th April, but this is an error since the *Hull Rockingham* and all subsequent accounts give the date as 28th April. The first notice, in the *Hull Rockingham* (7th May), gives the dimension as 58½ feet in length, from nose to the division of the tail, and the circumference, where the tail arose, as 8.0 feet. The pectoral fins were 5½ feet long and the lower jaw 16 feet from the extremity of the articulation. Of the forty-seven teeth, 24 were on the left side and 23 on the right. The same overall length is recorded on the print published soon after, engraved by R. Fenner from a drawing by Richard Iveson, though the girth near the tail is given as 7.0 ft 2 in and the number of teeth as 51.

Plate 2

The Burton Constable whale engraved by R. Fenner, London 1825.

Note the figure on the head using a measuring device,
an odometer or 'waywiser'.

A note of the stranding was entered into an account book of the Parish of Owthorne, largely derived it seems from the *Hull Rockingham*; the entry, signed B. Smith, repeats the dimensions published in that newspaper (27).

Iveson and Fenner

The Fenner engraving shows a ventral view of the whale, a male, with lower jaw dropped and displaying its complement of teeth. A top-hatted figure, somewhat small in regard to the size of the animal, is depicted standing on the head, an odometer or way-wiser in his hands (Plate 2). No doubt this is a thumb-nail sketch of the artist Richard Iveson by himself. He was steward for Sir Clifford Constable, who as the Lord Paramount of the Seignory of Holderness held the rights to whales stranded along the shores of his territory, both on the Yorkshire coast and within the estuary of the Humber (28). This engraving of the whale can be regarded as the official 'portrait' of the animal, undoubtedly paid for by Sir Clifford, and indeed the original copper plate was recently discovered in the stables of Burton Constable Hall. A lithographic print, quite obviously derived from it, is unsigned and omits the detailed dimensions, simply bearing the legend "Spermaceti whale. Length 58 feet 6 inches cast on the Holderness coast, 28th April, 1825". The overall shape is much the same, but the eye is clearly delineated and misplaced, high on the head, giving the creature a rather silly expression! The figure, still wielding his measuring instrument, is moved to a position behind the head and facing in the opposite direction, towards the head instead of the tail. The lithograph was no doubt the result of an enterprising local printer and would have been sold cheaply as a souvenir.

This latter version of the whale 'portrait' is reproduced in Loudon's *Magazine of Natural History* in 1829, accompanying a note by the noted Hull banker and local historian Thomas Thompson (29). Submitted on 28th May 1828, the text makes it clear that the editor had been sent both versions of the portrait:

> "*Physèter catòdon.* - You mention your regret at not being able to obtain a good drawing of the *Physèter catòdon*; I have, therefore, sent you two plates of one cast on the Holderness coast, in 1825; the larger plate was from a copy drawn by a land-surveyor [i.e. Iveson], and, though accurate as to admeasurement, is by no means so good a resemblance as the smaller one (fig. 114.), which is a very fair representation of the animal, as laid upon the shore [30]. Mr. Davies, the bookseller here [31], is in possession of an original drawing, by Mr. Dikes, which is said to be the best likeness taken of it".

That Thompson was able to pass his opinion on the accuracy of the various drawings and prints implies that he was one of the group of cognescenti who had journeyed from Hull to see this huge creature. Mr. Dikes (William Hey Dikes) was the curator of the museum of the Hull Literary and Philosophical Society, of which Thompson was a member. The latter finished his note by saying:

> "The skeleton is now at Burton Constable, the seat of Sir Clifford Constable. It was, however, about two years ago, in a very neglected condition, being laid in an irregular heap, in the middle of a field, as I have been told. Whether it has since been put together and taken care of, I have not heard".

Indeed the bones seem to have been neglected for some considerable while longer, since there are no payments to be discovered for the mounting of the whale until 1836.

Sir Clifford Constable

When the whale first came ashore, Sir Clifford, although he had succeeded to the baronetcy at the death of his father in 1823, had not yet reached his majority. This was celebrated at Tixall in Staffordshire with the slaughtering of two Durham oxen on 3rd May 1827, an event commemorated by a superb engraving of the two animals (32). Tixall was the principal home of Clifford's father, being more conveniently situated for those who enjoyed life in the metropolis. Sir Clifford married Marianne Chichester in September 1827, but the couple do not seem to have settled at Burton Constable until the late 1830s, and though Sir Clifford had sanctioned the preparation of the engraving in 1825 it is not clear whether he had actually set eyes on the creature or its remains prior to the 1830s. In 1840 he became patron of the Hull Literary and Philosophical Society, a position which had been vacant for several years since the death of Earl Fitzwilliam, the first to hold the office.

Exhibits of Blue Whales

A possible stimulus to the setting-up of the whale skeleton was the public display of the skeleton of a Blue Whale in Edinburgh and Glasgow in 1835. It was originally found in the neighbourhood of North Berwick in 1831, and was purchased by Dr. Knox and his brother Frederick Knox (Plate 3). The latter superintended the flensing and the preparation of the bones of an animal no less than 78 feet in length (33, pp. 138-139). An even larger example of a Sibbald's Rorqual (Blue Whale) was exhibited in London in 1833 and later toured America,

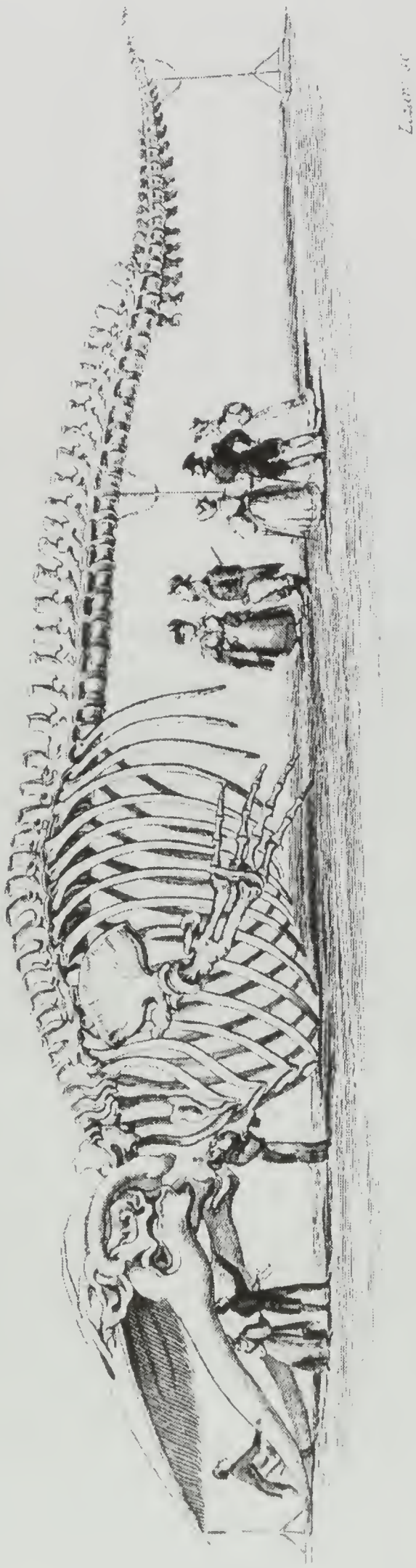

Plate 3

The Blue Whale washed ashore at North Berwick in 1831,
and acquired by the Knox brothers.

The size of this large specimen is exaggerated by less than life-size human figures.
The skeleton is now displayed in the Royal Museum of Scotland, Edinburgh.

this was a female 95 feet long (33, pp. 139-140). Closer to home was another Blue Whale, washed into the Humber in 1835, which the Hull Literary and Philosophical Society decided to exhibit in their museum (see later).

Dissection of the Whale

Once Sir Clifford was resident in the north and was able to give his full attention to the Burton Constable estate, the mounting of the whale proceeded. A certain John Thomas Butler, who has not been identified, received weekly payments starting on 3rd June which had amounted to £20 11-6d by 6th August 1836. Three more payments were made, the last on 27th August, making a grand total of £30 "for articulating the whale". On 2nd September, G.W. Headley received from Sir Clifford £30 10s 0d "for Smith's work". George Headley was a whitesmith and bell hanger, listed in the Hull trade directories in 1831 at 1 Bowlalley Lane, and c. 1835-1841 at 30 Lowgate. In 1837 he is described as a victualler and whitesmith at the Monument Tavern, 1 Junction Street, i.e. at the corner of Princes dock near the Wilberforce column (34).

Alderson

The dissection of the whale was conducted by James Alderson, and the detailed account of his anatomical findings appears in the *Transactions of the Cambridge Philosophical Society* of 1827 (35). James Alderson (Plate 4) was the son of Dr. John Alderson, an eminent physcian who had done much to develop the Hull General Infirmary as well as playing a key part in the cultural and intellectual life of the city; he was the founding father of both the Hull Literary and Philosophical Society, in 1822, and the Hull Mechanics Institute. James, who had entered Pembroke College aged 24 in 1818, took his B.A. degree in 1822 and gained a fellowship in 1823. Originally studying mathematics, he later transferred to medicine, becoming Bachelor of Medicine at Magdalen College, Oxford in 1826, and Doctor of Medicine in 1829, also at Oxford (36).

The dimensions of the whale are essentially the same as those which accompany the engraving and published in the press, and the informaton circulated at the time of the dissection would have emanated from Alderson and his fellow members of the medical profession and of the Literary and Philosophical Society, probably by way of Iveson, Sir Clifford's steward.

The scientific paper begins with an external description, in which Alderson tells us that although only 47 teeth were visible, two more, unerupted, teeth were found

Plate 4

Engraving of a portrait bust of Dr. James Alderson,
sculpted by J.E. Jones.

The original was displayed in the entrance of the old Hull Royal Infirmary,
but is now in the whaling gallery of the Hull Maritime Museum.

buried in the gum on the right side, thus making a total of 49, not 51 as indicated on the Fenner engraving. [A further unerupted tooth was discovered in 1995 shortly before the skeleton was recovered from the grounds at Burton Constable Hall]. Then follows a brief examination of the internal parts, and notes on the eye and heart. These portions must have been extracted and then examined at leisure back in Hull since some of the organs were later found to be incomplete.

> "The **larynx and oesophagus** were supposed to have been sent perfect with the heart, but on examination, it was ascertained that the oesophagus was wholly missing. The **urinary and genital organs** were not examined; they were removed, with other parts of the animal, during the time I was occupied in examination of the head. The **Stomach**. This organ was cut open by the labourers, not with a view to the examination of its structure, but in search of ambergris of which none was found.
>
> Near the termination of the oesophagus was found about a bucket-full of the beaks of one of the cuttle fishes. The **lungs and liver** were but cursorily examined; indeed the viscera were so quickly removed, with a view to cleaning the bones of the animal, that it was impossible to examine every organ" (35).

The paper is accompanied by a series of lithographic plates executed by C. Hullmandel after drawings by Christopher Richard Alderson (37), James' elder brother and also a physician. The ventral view is closer to that of the anonymous lithograph, but minus the figure standing on the carcase, and the prominent eye. It is accompanied by a dorsal view of the whale as seen on the beach. There is no acknowledgement to Iveson, so it is quite possible that both the scientific illustrations and the lithograph derive from drawings made on the spot by Alderson, who was living and working in Hull at the time of the stranding and probably accompanied his brother and other interested parties to the beach at Tunstall. Alternatively, Dikes or Iveson may have provided the original drawings (see above) and Alderson merely developed these. Succeeding plates show the lower jaw, dorsal and side views of the skull, the eye, a section of the eye, and one of the cuttle-fish beaks.

James Alderson concludes his publication by noting:

> "The bones are now in pits, where they will have to remain a considerable time. In the Autumn, probably the process of articulating will be commenced, and from the known zeal of the steward (Mr. Iveson of Hedon) of the estate, there is every probability of it being completed in a skilful manner".

Although not published untill 1827, the paper was submitted on 14th July 1825 and read to the Society on 16th May, little more than a fortnight after the whale

was stranded. The various portions of the soft tissue would have been preserved in alcohol or formalin for the Literary and Philosophical Society's Museum and probably for the anatomical collections of the infirmary too. We know that "portions of the aorta and heart" were presented to the Yorkshire Philosophical Society in 1827 by a Mr. G. Sawyer (38).

Delay

For whatever reason (but largely one presumes because of Sir Clifford's residence in Staffordshire) the bones were not assembled until eleven years had passed since the stranding, and Thompson tells us in 1829 that they were then in a neglected state. A year before this we do know that John Phillips, the pioneer geologist of the Yorkshire coast (39), went to Burton Constable to see the remains. He was accompanied by the Rev. Christopher Sykes (40) and Mr. Isaac Stickney, a Quaker farmer (41). The visit, on 7th June, is recorded in his diary accompanied by a series of sketches, one at least, a schematic drawing of the arrangement of bones in the flipper, being accompanied by the initials RI 1826 (42). This indicates that Phillips copied the sketch from an original by Richard Iveson. There is also a drawing of the upper surface of the skull, some vertebrae, and a side view of the skull. Two human figures, one on top and one at the rear, give an exaggerated impression of the bones' size. A note accompanying the drawings reads as follows:

> "The bones of the large whale of 1825 are now in a general state of dryness for mounting - except those of the tail [43] - which hung in [illegible] from a tree. In a barn we found the vertebrae, scapula, lower jaw bone, ribs, sternum and part (temp[oral] bones) of head. (possibly also coracoid processes)".

Phillips

Phillips, who was curator of the museum of the Yorkshire Philosophical Society from 1824, and Sykes had themselves prepared a skeleton of a Lesser Rorqual whale washed upon the Holderness coast in 1828 (44). As might be expected, there were other contacts between the Y.P.S. and the Hull Literary and Philosophical Society and in 1824 Phillips was engaged by the latter to give a series of nine lectures entitled "On the Formation of Coal". During his visits he helped to arrange the collections of minerals and fossils in the museum and was duly elected an honorary member of the society in 1825 (45).

Beale

It was another medical gentleman, a surgeon, Thomas Beale (46), who made details of the Burton Constable whale available to a wider public in his *The*

Natural History of the Sperm Whale published in 1839 (50). This followed an earlier slim volume, a 58-page pamphlet, *A Few Observations on the Natural History of the Sperm Whale* (1835) which provided only a general description of the sperm whale and its habits, and concluded with the hunting and processing of the whale (47).

Wallis

Mr. Pearsall of Hull (48), a member of the Hull Literary and Philosophical Society, brought Beale's attention to the skeleton "of an adult Sperm Whale" at Burton Constable and as a result he "embraced an opportunity which offered itself to visit it". He further tells us that the:

> "...skeleton was preserved and articulated only about two years since, I believe principally under the superintendence of the Mr. Wallis, of Hull, surgeon [49], who was singularly capable of undertaking its dissection, from the great attention he had paid to the anatomy of some other whales, especially to that of the finner and Baleana mysticetus" (50).

The likelihood is that Wallis was present on the beach and assisted when the whale was being examined by Alderson and various colleagues. Wallis was lecturer in anatomy and pathology at the Hull School of Anatomy and Medicine, of which he and James Alderson were both proprietors (51), and would surely have been closely involved in the original dissection. Beale goes on to say:

> "This gentleman who possesses much valuable information on the anatomy of the upper part of the trachea with the lower portion of the blow hole [of the finner and B. mysticetus] ...a pleasant rivalry was manifested among the scientific gentlemen of Hull, in showing and explaining to me all that they knew respecting the leviathan of the deep, of which the Museum of Natural History of Hull can boast of several fine skeletons, particularly that of a finback of gigantic dimensions, and which was prepared by Mr. Wallis" (50).

The Humber Blue Whale

This latter is the Blue Whale washed up at the mouth of the Humber in 1835 (Plate 5), which had evidently been prepared and mounted for display in the museum of the Literary and Philosophical Society with rather greater expedition than the Tunstall Sperm Whale, in fact either in 1835 or in 1836, the same year that the Sperm Whale was erected in the grounds of Burton Constable (52).

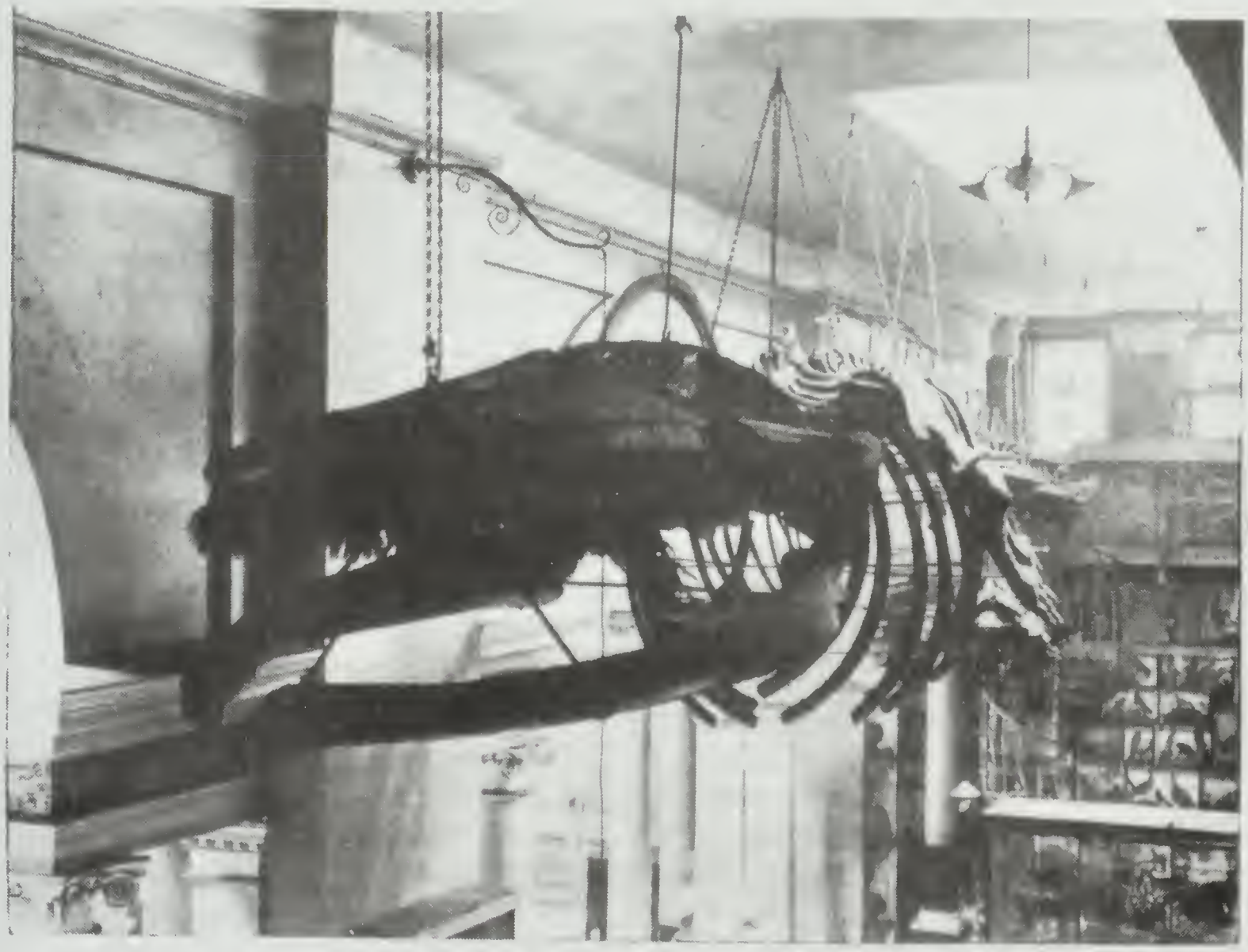

Plate 5

Skeleton of a Blue Whale displayed in the Royal Institution, Hull, until 1935 and now in the Natural History Museum, South Kensington.

The museum of the Hull Literary and Philosophical Society was given into municipal control in 1900.

Articulation of the Burton Constable Whale

An offprint of Alderson's article in the *Transactions of the Cambridge Philosophical Society* was leather bound and presented to Sir Clifford Constable. It is inscribed on the flyleaf:

> "To Sir Thomas Aston Clifford Constable Baronet, this short notice of the Spermaceti whale, the skeleton of which has been articulated by his direction and which forms a valuable specimen of natural history unique in Great Britain, is presented by his obliged and obedient humble servant James Alderson".

Sir Thomas only commissioned the articulation, and it is unlikely that Alderson himself superintended the assembly of the skeleton owing to his professional commitments, although he no doubt retained a proprietorial interest in the remains. In 1830 Alderson had been elected Senior Physician to Hull General Infirmary in succession to his father, who had died in September the previous year (53). He also inherited his father's extensive and lucrative private practice, both of which would have fallen to his elder brother Christopher had he not predeceased their father, having died in February 1829.

Beale's claim that Wallis had charge of the articulation is almost certainly accurate, and the Mr. Butler who received payment no doubt executed the actual physical work of assembly. The likelihood is that he was a technical assistant or preparator at the Medical School in Hull. It is worth noting that the Medical School, the facade of which still stands, was situated in Kingston Square and faced across to the Assembly Rooms, on the opposite side. The Museum of the Literary and Philosophical Society was situated within the Assembly Rooms and was the original home of the skeleton of the Blue Whale (54).

The description of the Sperm Whale in Beale's 1839 volume is considerably expanded, incorporating not only much of Alderson's published account but also using Hunter's seminal paper on whale anatomy published in the *Philosophical Transactions* in 1787 (55). In addition he incorporates observations on the eye and teeth of the Sperm Whale, derived from a paper presented to the Zoological Society by F.D. Bennett in 1836 (56) and "an extract from Professor Jacobs, on the structure of the skin" (50, p. 72). Bennett was another surgeon, who like Beale had sailed to the southern whale fishery and a detailed account of his travels was published in 1840 (57).

Altogether the description of the Sperm Whale by Beale amounts to 135 pages, followed by a history of the Sperm Whale fishery; notes on the methods of hunting and processing the whale make another 56 pages, the remainder of the near four hundred pages being Beale's sketch of a South Sea voyage.

Alderson's publication and Hunter's work are Beale's major sources, and there is no indication from the text that Beale himself had undertaken any dissection or detailed examination of a Sperm Whale carcase on his voyage. He would, of course, have seen the flensing operation (the removal of the blubber) and the bailing out of the spermaceti from the head, but none of the whalers' normal activities penetrate into the body to reveal internal organs. After the blubber had been removed and the 'case' bailed, the carcase was cast adrift for the sharks. Bennett during his voyage had at least dissected a whale foetus recovered from one of the 'kills' (57, vol. 2, p.167).

Moby Dick

Both Beale's and Bennett's records of their voyages provided valuable information for Herman Melville, which was absorbed into the text of *Moby Dick*, a now classic novel concerning the obsessive search for the great white whale by Captain Ahab of the *Pequod* (58). Melville himself had personal experience of life aboard a whaleship, 1841-1843, and this inside knowledge certainly adds enormously to the powerful story (59). Melville purchased his own copy of Beale's book on 10th July 1850 for the sum of three dollars thirty-eight cents. It survives in a private collection, replete with comments and notes scribbled in the margins (60).

Chapter 102 of *Moby Dick* "A Bower in the Arsacides" contains a wonderfully extravagant description of the Burton Constable whale. The skeleton is described as if not merely articulated in the scientific sense of being reassembled, but as though fully mobile, a virtual automaton:

> "Sir Clifford's whale has been articulated throughout; so that like a great chest of drawers, you can open and shut him, in all his long cavities - spread out his ribs like a gigantic fan - and swing all day upon his lower jaw. Locks are to be put upon some of his trap doors and shutters; and a footman will show round future visitors with a bunch of keys at his side. Sir Clifford thinks of charging twopence for a peep at the whispering gallery [61] in the spinal column; threepence to hear the echo in the hollow of his cerebellum; and sixpence for the unrivalled view from his forehead" (62, pp. 375-376).

Emphasising the source of his inspiration, Melville also says "There is a Museum they tell me in Hull, England, one of the whaling ports of that country, where they have some specimens of fin backs and other whales".

In the following chapter "Measurement of the Whales Skeleton" there is a lively piece clearly inspired by Beale's, and ultimately Alderson's, details of the Sperm Whale's dimensions, but exaggerated and peppered with hyperbole and nautical simile (62, pp. 376-378).

Thus it was that a whale washed ashore on the Holderness coast in 1825 became immortalised in the pages of a literary classic (63). At the time, whales were of especial interest in Hull, which was at the high-water mark of its success as a great whaling port. This made the stranding of particular interest to the learned members of the Literary and Philosophical Society, who included among their members a number of talented medical men.

Anyone with any zoological or anatomical knowledge, and also alive to the significance of the whale to Hull's economy would undoubtedly be roused by news of the stranding of one of the great whales on the nearby coast. So it was that Dr. Alderson was able to make his own small contribution to cetacean biology and unknowingly provided the basis for an amusing passage in Melville's famous novel.

Conclusions

In the 1830s cetaceans, and especially the great whales, received a tremendous amount of attention. Stranded whales were widely publicised, and many were presented by entrepreneurs as major public attractions. Most notably the skeleton of the enormous Ostend whale was transported all over Western Europe. The books of Beale and Bennett, relating their voyages in the south seas in pursuit of the Sperm Whale, were important for transmitting knowledge of the great whales to a much wider audience than specialist scientific investigators and anatomists.

A Sperm Whale came ashore at Whitstable in Kent in 1829, and a large whale of undetermined species, stranded on 31st December 1830, was illustrated in a print (15, p. 202) shown lying at the base of the chalk cliffs not far from Brighton. The 95-feet Blue Whale found floating off Ostend in 1827 was subsequently prepared and shown in France, Belgium, Holland and England in the years 1828-1834 (64). In Scotland in 1831 an 83-feet Blue Whale which stranded near North Berwick (see Plate 3) was purchased by the Knox brothers, who spent over three years dissecting and preparing it for eventual display in Edinburgh and Glasgow. This skeleton was illustrated by Sir William Jardine in the *Naturalist's Library*

volume published in 1837 (33, Plate 6, p. 138) and is still a major presence in the Royal Museum of Scotland, Chambers Street, Edinburgh.

Hunter's 1787 paper forms the foundation stone of modern studies of whale anatomy and the development of scientific cetology. His work was greatly advanced in the nineteenth century by Dr. John Edward Gray (1800-1875) author of the catalogues of the cetaceans in the British Museum, numerous related papers in the *Proceedings of the Zoological Society*, and joint author (with Sir John Richardson) of *The Zoology of the Voyage of H.M.S. Erebus and Terror during 1839-43*, &c (65).

The direct contribution by James Alderson to our knowledge of the cetacea can ultimately be seen to be marginal, and his paper published in a university journal of limited circulation might easily have been forgotten. Instead his work provided the stimulus for Beale to produce his enlarged account of the *Natural History of the Sperm Whale* in 1839. Beale, Bennett, and Scoresby together provide the observations of the great whales in their natural environment, not stranded or otherwise dead, and a basis for the work of the twentieth century field zoologists.

As well as the more accessible works of Beale, Bennett and Scoresby, around this time there appeared many large scientific tomes, which included detailed anatomical information on the cetacea. The year 1851 saw the appearance of the English edition of Cuvier's *Animal Kingdom,* a translation from the 1829 French original. Jardine's popular work of 1837 (33) digested and summarised the growing corpus of information provided by Lacépède, Cuvier, Hunter, Scoresby and others. Each of the cetacean species then known is described and accompanied by an engraved illustration generally of a high standard. The volume was widely circulated and the illustrations frequently copied in later works.

The 1830s brought the whale tribe, especially the great whales, centre stage for a wide public, and they received an intensive focus not seen again until this century. The depredations of the centuries of open-boat whaling made some impact on whale populations but the massive over-exploitation of whale stocks by the whale factory ships led to a serious threat of extinction of several species, in particular the Blue Whale, the largest creature that has ever lived on earth. The large-scale sympathy for the plight of the whale encouraged the development of organised conservation groups, which have campaigned for a ban on whaling and world-wide protection of threatened species.

Beached cetaceans still continue to fascinate, whether large individual whales (see Plate 6) or the mass strandings of Pilot Whales, all of which are widely

reported in the media. In recent times complete carcases, preserved in formalin have been taken on tour throughout Europe. The gigantic whale exhibition in 1901 and Jonas the whale in 1952 are two instances; both were specimens of the Blue Whale. From the 1970s onwards, dolphinaria became popular attractions displaying the antics of the smaller species, usually Bottle-nosed Dolphins, occasionally Killer Whales or even Pilot Whales. More recently, conservation groups have severely criticised these shows because of the limited space given to the animals and the constant need to seek yet more dolphins to replace those which die in captivity (66). It is perhaps surprising to find that the display of live whales goes back to the last century; a Bottle-nosed Dolphin was shown in Boston in 1861, and Belugas were shown by P.T. Barnum at New York in 1861-62.

This paper has attempted to outline the increasing knowledge and awareness of the whale tribe through the centuries, and the development of a serious zoological interest in the creatures which has become an independent discipline we call cetology. In the early nineteenth century, and particularly the 1830s, we see the burgeoning of the modern era of whale study, and one whale in particular, the Burton Constable spermaceti whale, was a vital stimulus to the evolution of cetology. In addition, it has been immortalised in that great adventure story and work of literature *Moby Dick,* a novel which continues to encourage a fascination with the great whales and man's involvement, often cruel and brutal, with these magnificent marine mammals.

The skeleton of the Burton Constable whale, erected near the house, had long since collapsed and become overgrown and half buried in the soil when it was decided to attempt its recovery. Between 3rd and 13th September 1996 the site was excavated by zoologist M.J. Boyd and the bones taken indoors for excavation and cleaning (Plate 7). Most of the skull, spinal column and flippers (minus the phalanges) were recovered, amounting to some 70% of the total skeleton. It is planned that in the near future these remains will be suitably mounted and one again placed on public display, but this time indoors and safe from further decay.

Acknowledgements

The author's thanks are due to Dr. David Connell, Director of Burton Constable Hall for permission to publish material pertaining to the skeleton of the Spermaceti Whale, and to Mr. M.J. Boyd who salvaged it from its derelict state. Thanks are also due to Professor W.J. Kennedy of Oxford University Museum for permission to use extracts from the Phillips archive.

Plate 6

A 49-feet Sperm Whale washed ashore on the Lincolnshire coast, at Skidbrooke, in 1974.

Plate 7 (a)

Part of the skull of the Burton Constable whale after recent cleaning.

Plate 7 (b)

A scapulo-coracoid and rib of the Burton Constable whale after recent cleaning.
(Note the metal fixing on the rib).

Notes

1. Pliny the elder, a victim of the eruption of Vesuvius, died in A.D. 79.

2. Pierre Bélon: *L'Histoire Naturelle des Etranges Poissons Marins,* Paris 1551; and *De Aquatilibus,* Paris 1553.

3. Guillaume Rondelet: *Le Premiere Partie de L'Histoire Entire des Poissons,* Lyons 1558; the original edition in Latin, *Libri de Piscibus Marinis, in quibis verae Piscium Effigies Expressae sunt &c,* was published in 1553. Chapter sixteen deals with cetaceans.

4. T. Bartholinus: *Historiarum Anatomicarum Rariorum Centuria,* Hafniae 1654.

5. John Ray. An account of the dissection of a porpess; made and communicated in a letter of Sept 12th, 1671". *Philosophical Transactions,* London, Volume 6, No. 74, p. 2220 and No. 76, pp. 2274-2279.

6. Friderich Martens: *Spitzbergische oder Groenlendische Reise-Beschreibung gethen im Jahr 1671,* Hamburg 1675.

7. Robert Sibbald: *Phaloenologia Nova,* London 1692; reprinted Edinburgh 1773.

8. John Hunter. Observation on the structure and oeconomy of whales. *Philosophical Transactions,* London, Volume 77, pp. 371-450, 11 plates, xvi-xxiii; read 28th June 1787.

9. William Scoresby. Account of the *Balaena mysticetus*, or Great Northern or Greenland Whale. *Memoirs of the Wernerian Natural History Society,* Edinburgh 1811, Volume 1: 578-586 and one plate.

10. William Scoresby: *An Account of the Arctic Regions, with a History and Description of the Northern Whale-Fishery.* Edinburgh, 1820; later reprinted, e.g. Newton Abbot, 1969.

11. C.G. Zorgdrager: *Bloeyende Opkomst der Aloudè en Hedendaagsche Groenlandsche Visschery &c,* Amsterdam 1720. A German edition was published in Leipzig 1723, another at Nuremburg in 1750, and several more editions in Holland.

12. *Walvische of Tonyn, Gestrand te Zandvoort;* drawn by Hendrik Goltzius, probably engraved by Jan Sanredam. See Klaus Barthelmess and Joachim Münzing, "Monstrum Horrendum". *Schriften des Deutschen Schiffahrtsmuseums*, Vol. 29, part 2, pp. 92-93. Bremerhaven, 1991.

13. Engraved by Jacob Matham of Haarlem; the original drawing by Goltzius is in the Teylers Museum, Haarlem.

14. Record in J.A. Allen: Preliminary list of works and papers relating to the mammalian order Cete and Sirenia. *Bulletin of the United States Geological and Geographical survey of the Territories,* Washington 1881, Volume 6, No. 3, pp. 399-562.

15. Elizabeth Ingalls: *Whaling Prints in the Francis B. Lothrop Collection,* Salem, Massachusetts 1987.

16. The whale, at least the Greenland Right Whale, had for some eighty years been a major source of wealth for Hull merchants and shipowners, but by 1830 the fleet had nearly halved from the peak of 61 vessels in 1821. This still represented a major involvement in the Arctic fishery, and the people of Hull and east Yorkshire had an ongoing interest in the great whales.

17. *Gentleman's Magazine,* September 1750, p. 426.

18. Anatomists such as John Hunter developed a network of contacts, mainly of medical men, who were able to provide them with the whole or part of a whale, dolphin or porpoise which had stranded in their neighbourhood. Hunter's great friend Edward Jenner, the originator of smallpox innoculation, was one of these helpers.

19. There are populations in the northern and southern hemispheres and Sperm Whales roam the sea from the far north to the Antarctic. In European waters, stranded Sperm Whales tend to be lone males which have separated from the herd, perhaps because of age or infirmity.

20. There are no external ears, only small ear holes, halfway between the eye and the pectoral fin.

21. This is an elongated hump rather than a true fin.

22. Not a perfume in its own right, but used as a fixative to prolong otherwise fugitive aromas.

23. i.e. c.1762 and c.1747 respectively.

24. Unfortunately the principals are not named.

25. *Hull Rockingham,* 14th May 1825.

26. *Hull Advertiser,* 6th May 1825.

27. Inserted as a note of an event of great local interest in an *Account Book of Byelaw Disbursements for the Open Field Management of Owthorne, 1732-*

1795 (Hull Local Studies Library). Discovered by Mel Cotman and first reported in the *East Yorkshire Local History Society Bulletin*, No. 55, Winter 1996-97, p. 28.

28. As stated in a letter from William Iveson (1764-1843, attorney-at-law) to the Rev. John Gilby of Beverley, 17th August 1814, rights were claimed by the Lord Paramount on "The whole shore of Holderness within the flux and reflux of the sea subject to such right of passage thereon as the Kings subject are entitled"; Hull University Library DD WB (2) 9/2.

    Generally whales and sturgeons were declared 'Royal Fish' and became the prerogative of the crown, but in several places the local potentate traditionally had the right to take such animals, e.g. the Bishop of Durham; see J.L. Drury, The Bishop of Durham's whale, *Bulletin of the Durham County Local History Society,* 25th December 1986, pp. 39-52.

29. His note was published posthumously, in Loudon's *Magazine of Natural History,* Vol. 2, 1829, p. 477 and Fig. 114. Thomas Thompson (1754-1828), a merchant and banker, was a partner in the firm of Wilberforce and Smith at the house in the High Street now known as Wilberforce House, birthplace of the emancipator. He was a staunch methodist, a keen local historian, and was linked to the Aldersons through his son John Vincent Thompson, who had married Margaret Alderson, sister of Christopher and James. See A.R.B. Robinson: *The Counting House,* York 1992.

30. In the Fenner engraving there are curious bulges where the lower jaw joins the body, and the outline of the tail flukes is not clearly delineated.

31. Rees Davies, printer, bookseller, binder, stationer and engraver. Only traced in one Hull directory, that for 1831 when he was working at 29 Lowgate. G.W. Headley, the smith, was at 30 Lowgate c. 1835-41.

32. An engraving by Charles Turner after a painting made by T. Weaver of Shrewsbury.

33. Sir William Jardine: *On the Ordinary Cetacea or Whales* (Vol. VI of *The Naturalist's Library*), Edinburgh 1837.

34. A metal plate is fixed to the wall outside the billiard room at Burton Constable Hall, and evidently relates to the series of bells ranged around the walls by which servants could be summoned to every part of the house. It is inscribed "G.W. Headley Whitesmith and Bellhanger, 30 Lowgate, Hull, 1837". He had evidently installed the system, though whether he gained this job as a result of an initial involvement in the whale or vice versa is not known.

35. James Alderson. An account of a whale of the Spermaceti tribe cast on shore on the Yorkshire coast, on the 28th April, 1825. *Transactions of the Cambridge*

Philosophical Society, paper XV, 1827, pp. 253-266 and three pages of illustrations.

36. James Alderson, 1794-1882. See Ray Luffingham: *John Alderson and his Family,* Hull Medical Society Centenary Monograph, No. 21, 1995; and *The Manuscript of Sir James Alderson*, Hull Medical Society Centenary Monograph, No. 22, 1995.

37. Christopher Richard Alderson (1787-1829), elected Physician to the Hull Infirmary on 9th September 1824, but died in his forty-first year on 7th February 1829.

38. *Annual Report of the Yorkshire Philosophical Society, 1827.* York 1828, p. 52.

39. John Phillips (1800-1874), nephew and protege of William Smith the 'father of British geology'. From 1824 to 1840 he was Curator (Hon. Curator till 1844) and Secretary of the Yorkshire Philosophical Society. In 1834 he was appointed Professor of Geology at King's College, London and in the same year was elected F.R.S. He was Keeper of the Ashmolean Museum 1854 - 1870, and had been made a Fellow of the Geological Society in 1828, of which body he was President 1859 - 1860. He was the author of *Illustrations of the Geology of Yorkshire* Vol. 1 (1829), Vol. 2 (1836), *Treatise on Geology* (1837), etc.

40. Christopher Sykes M.A. (1774-1857), Rector of Roos, east Yorkshire, younger son of Sir Christopher Sykes Bt. (1749-1801) of Sledmere, east Yorkshire.

41. Isaac Stickney (1769-1846) was a younger brother of William Stickney (1764-1848) of Ridgemount, who was an honorary member of the Hull Literary and Philosophical Society from c.1827. William was an agricultural improver, and received the silver medallion of the Agricultural Society in 1826 for his improved variety of Rye Grass. His farm in the parish of Burstwick was part of the Burton Constable estate. See H. Alison Kay: *William Stickney, 1764-1848,* York 1980 (Privately published for the author).

42. Oxford University Museum, Phillips Box 42, folder 19, Phillips notebook, 7th June 1828. I am grateful to Simon Knell, Department of Museum Studies, University of Leicester, for bringing this to my attention.

43. He presumably means the tail end of the spine, since there are no bones within the tail flukes which consist solely of skin, muscle and sinew. The tail with its up and down motion propels the animal through the water.

44. A letter to Phillips at York, the "Phil. Soc. Rooms", from Sykes at Roos dated 25th July 1828, asks where he is to send a hamper of "the smaller parts of the tissues, which you wish to be sent for your person to prepare them. The larger bones, the head, ribs etc are now hung out to bleach in the sun and the rain and it will be some months before they are in a fit state to send as the incessant rains have retarded the oil from oosing (*sic*) from them. The pit I have not

examined since they were put into lime etc" (1828/9 Sykes letters; Oxford University Museum).

45. Annual Reports of the Hull Literary and Philosophical Society, *passim.* (Hull Local Studies Library).

46. Thomas Beale (1807-1849); student at the Aldersgate medical school 1827-29; he stayed on as an assistant in the dissecting room and later was assistant curator. He moved to the London Hospital and in 1830 sailed as surgeon aboard the South Seas whaleship *Kent,* belonging to Thomas Sturge. He died tending his patients at the Stepney Poor House during the cholera epidemic of 1849.

47. He had presented a paper on the Sperm Whale to the Eclectic Society in London, for which he was awarded their silver medal. This encouraged him to publish, with the aid of subscribers, *A few Observations on the Natural History of the Sperm Whale,* London 1835.

48. Thomas John Pearsall, 31 Sykes Street, Hull, an honorary member of the Hull Literary and Philosophical Society from c. 1838. Though Dikes was overall curator of the Society's museum, Pearsall seems to have had particular responsibility for the cetacean material (see below). He was the author of the *Second Report of the Examination of River Hull water,* 1842, 9 pp.

49. Surgeon and lecturer in anatomy and pathology, of the Hull and East Riding School of Anatomy and Medicine established in 1831. His cousin Thomas Wilkinson Wallis (1821-1903) was a celebrated wood carver and was the creator of the famous dragon chair for Lady Marianne and Sir Clifford Constable in 1840. He won a medal at the Great Exhibition for carvings executed in the manner of Grinling Gibbons. See *Autobiography of Thomas Wilkinson Wallis*, Hull, 1899.

50. Thomas Beale: *The Natural History of the Sperm Whale,* London 1839.

51. The other partners were R.M. Craven, Robert Hardey and G.D. Longstaff.

52. See Thomas Sheppard, Notes on the skeleton of Sibbald's Rorqual in the Hull Museum. *Naturalist,* August 1901, pp. 233-240 (reprinted as *Hull Museum Publications.* No. 1, 1901). This example was the first of its kind to be scientifically described and therefore became the type specimen of the Blue Whale to which all others are compared for identification. See J.E. Gray, On the Finner Whales, with the description of a new species. *Proceedings of the Zoological Society of London,* 1847, pp. 88-93, (Blue Whale on pages 92-93). Gray received his description of the Blue Whale skeleton from Pearsall (who had contacted Beale about the Sperm Whale), described as the curator of the Literary and Philosophical museum.

53. A number of candidates had put their names forward: George Longstaff, F.R. Horner and Dr. Randall, but all withdrew in favour of James Alderson.

54. Later transferred to the Royal Institution, Albion Street, which became the Hull Municipal Museum in 1900. The Blue Whale skeleton was sent to the Natural History Museum, South Kensington, in 1935 by Thomas Sheppard the curator at the prompting of Alister C. Hardy (1896-1985). This eminent scientist, who became a Fellow of the Royal Society and was knighted, had established the Department of Zoology at University College, Hull, and was professor there for fourteen years, during which time he invented the continuous plankton recorder and undertook fundamental research into the feeding habits of commercial fish.

55. John Hunter (1728-1793), Observations on the structure and oeconomy of whales, *Philosophical Transactions of the Royal Society,* Vol. 77, 1787, pp. 371-450. (Also *Philosophical Transactions,* Vol. 16, 1809, abridged series pp. 306-351).

    Always eager to widen his knowledge of mammalian anatomy, he gained first refusal of the carcases of any of the animals which died at the menagerie in the Tower of London. He also collected human skeletons, including those of dwarfs, and most famously that of O'Brien the Irish giant which still survives in the museum of the Royal College of Surgeons.

56. Frederick Debell Bennett, 'Notes on the anatomy of the Spermaceti Whale'. *Proceedings of the Zoological Society of London*, 1836, pp. 127-129.

    F.D. Bennett (1806-1859) was admitted Licenciate of the Society of Apothecaries in 1828 and became M.R.C.S. in 1829, in which year he also became assistant surgeon aboard the hospital ship *Grampus* moored by Greenwich Hospital. In 1833 he left London aboard the South Sea whaler *Tuscan,* returning in 1836 with a large collection of botanical and zoological specimens. A corresponding member of the Zoological Society, he made contributions to the *Proceedings* in 1836, 1837 and 1840. See also I.A.D. Bouchier, The polymath practitioners - Thomas Beale and F.D. Bennett, *Practitioner,* September 1976, pp. 428-430.

57. F.D. Bennett: *Narrative of a Whaling Voyage round the Globe from the Year 1833 to 1836,* 2 volumes, London 1840.

58. Herman Melville, *Moby Dick*; first published in America and England in 1851. Melville had visited England in 1849 to see his publisher in London, but never visited Hull or Yorkshire.

59. He sailed from Nantucket in the *Acushnet* in 1841, and returned in the *Charles and Henry* in 1843.

60. See Jay Leyda, *The Melville Log,* New York 1969, p. 377, quoting from Melville's diary. See also Howard P. Vincent, *The Trying-out of Moby-Dick,* Ohio 1980, *passim.*

61. Melville had visited the 'whispering gallery' in St. Paul's Cathedral during his visit to London.

62. *Moby-Dick,* Norton Critical Edition, New York, 1967.

63. The book was also an inspiration to J.M.W. Turner, who painted four canvases with whaling themes. Three of them, when exhibited at the Royal Academy, had extracts from Beale's 1839 volume appended to their entries in the catalogue. The pictures relate to dramatic incidents described by Beale in the pursuit of the Sperm Whale. See A.G. Credland, The Burton Constable whale p. 103, note 199, in Ivan and Elizabeth Hall's *Burton Constable Hall,* Hull 1991. See also Honore Forster, British whaling surgeons in the south seas 1823-1843, *Mariner's Mirror,* Vol. 74, No. 4, November 1988, pp. 401-415.

64. The Ostend whale was displayed at Charing Cross.

65. Gray entered the British Museum in 1824, and was Keeper of Zoology there until shortly before his death. Elected a Fellow of the Royal Society in 1832, he wrote a great many of the museum descriptive catalogues virtually single-handed.

66. See Richard Ellis: *Men and Whales,* New York 1991, pp. 332-334. Belugas were delivered to aquaria in Manchester, Blackpool and London in 1878, and the circumstances of the latter, shown at the Westminster aquarium, are described in a pamphlet by Henry Lee, *The White Whale,* London 1878, 16pp.

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D'ARCY THOMPSON, ALEXANDER RODGER, AND THE SECOND BERING SEA VOYAGE OF 1897

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Introduction

On 4th April 1897 Alexander M. Rodger, Curator of the Perthshire Natural History Museum, applied for, and was granted, six months leave of absence - his salary to cease while he was away. Four months later, almost exactly one hundred years before the presentation of this paper, he was writing a postcard to his travelling companion and mentor, D'Arcy Wentworth Thompson, to announce that the photographic negatives from their trip had been forwarded to Valentines in Dundee for printing (D'Arcy Thompson Index, 1987: item 9925). The plates attached to this paper are a small selection of those which survive in the collections of Perth Museum and Art Gallery and which were used, as lantern slides, on 10th February 1898 when Alex. M. Rodger gave a lecture to the Perthshire Society of Natural Science entitled 'Notes of a Journey to the Bering Sea' which was 'illustrated by lime-light views' (*Transactions and Proceedings of the Perthshire Society of Natural Science*, 2: clxi).

D'Arcy Thompson - Professor of Natural History at Dundee

D'Arcy Thompson had taken up the Boyd Baxter Professorship of Biology at University College, Dundee in 1884, although between 1888 and 1917 his position was designated 'Professor of Natural History'. In 1886 Alexander M. Rodger, an apprentice plumber, joined his department as a laboratory assistant. The young man helped enthusiastically with the creation of D'Arcy Thompson's departmental museum, which developed a strong Arctic element in its collections - mainly through D'Arcy Thompson's connections with the local whaling captains. Alex Rodger sailed on two whaling voyages in the North Atlantic, collecting specimens, and also accompanied D'Arcy Thompson and a group of students to Norway. In November 1889, one hundred and fifty Pilot Whales came ashore in Orkney (T.E. Buckley and J.A. Harvie-Brown, 1891, *A Vertebrate Fauna of the Orkney Islands;* Edinburgh: David Douglas). D'Arcy Thompson wrote "we sent Aleck up post-haste, with some new and formidable knives, he is having a good time" (D'Arcy Thompson Index, 1987: item 4432).

Alexander M. Rodger - Curator of Perthshire Natural History Museum

In 1895, Alex Rodger became the first salaried Curator of the Perthshire Natural History Museum and brought his skill, his enthusiasm and his contacts with him. He was aware of museum developments in Europe and the U.S.A., and was responsible for the creation of new and more didactic displays in the recently extended museum. The Index Gallery, with its strong educational element, was put together using the theories of Sir William Flower who had transformed the British Museum (Natural History). Ultimately the Index Gallery would contain a large Arctic display containing specimens acquired mainly through Alex Rodger's Dundee contacts. With Alex Rodger at the helm the museum went from strength to strength until his early death in 1914.

First Bering Sea Voyage

When D'Arcy Thompson prepared for his first trip to the Bering Sea in 1896 he was assigned a Sapper Marratt, from the Royal Engineers, as photographer and servant. It seems that he asked for Marratt again in 1897 but he was not available. Thompson needed someone he could rely on, and turned to Alex.

The prompt for the despatch of D'Arcy Thompson to the Bering Sea was the continued decline in Fur Seal numbers, which threatened the important sealing industries of the U.S.A. and Britain. The idea was that the efficiency of the newish regulations governing sealing was to be assessed along with the number of seals and the causes of mortality amongst the pups. D'Arcy Thompson was delighted to go.

The results of this first expedition, and lots of incidental detail, are well chronicled in the archives at St. Andrews University. However, it became obvious that a second expedition was needed and, strangely, there is comparatively little detailed information on this in the extensive correspondence and papers at St. Andrews. Perhaps they lurk in a Foreign Office file or perhaps, since D'Arcy Thompson admitted "I myself came very unwillingly on this second expedition" (D'Arcy Thompson Index, 1987: item 43290), they were not treated as enthusiastically as the records of the first trip.

Second Bering Sea Voyage

The two travellers set off in April 1897 on the *Oceania* to Marseilles. From there, the S.S. *Armand Betric* took them via Suez to Ceylon, Bangkok, Formosa, Saigon, Hong Kong, and Yokohama where they stayed at the Grand Hotel from

3rd June. Here H.M.S. *Centurion* took them to Hakodate where they transferred to H.M.S. *Rainbow* (Plate 1), which would be their transport for the next two months. D'Arcy Thompson apparently looked back on this time with delight, and he obviously felt at home on board. Ten days after leaving Japan, *Rainbow* made land at Robben Reef, a tiny Russian island with a beach twenty-five yards square holding four hundred and thirty-one Fur Seals. The Russian Gunboat *Koretsc* was already there, having landed a small party to guard the colony. With due formality, the *Rainbow*'s officers paid their respects to their opposite numbers while Alex recorded the scene with his camera. The *Rainbow* then headed for Copper Island (Plate 2) via Petrapovlosk (Plate 3).

Early July was spent on Copper Island (part of the Komandorski Group) where D'Arcy Thompson procured a skeleton of the extinct Steller's Sea Cow for his museum. This specimen is now part of the collections of the National Museums of Scotland. Seals were driven from the beaches up steps cut in the cliffs to the killing grounds beyond. Thompson recorded the process and the numbers of seals and sealers involved, while Alex took the photographs (Plate 4).

In mid-July 1897 the party moved on to Bering Island, where G.E.H. Barrett-Hamilton, of the British Museum (Natural History), was continuing his studies from the previous year in co-operation with scientists from the U.S. National Museum. Dog teams were used by the Aleuts to move skins and seal meat from the killing grounds, and the party used the sleighs (Plate 5) to take them to the north and south rookeries. At the end of July Barrett-Hamilton left for Copper Island on H.M.S. *Linnet* (Plate 6) and D'Arcy Thompson and Alex Rodger sailed for the Pribiloff Islands, arriving in St. Georges on 1st August 1897. They spent four days counting seals at the base of the steep cliffs before moving on to St. Paul's Island.

On 16th August they embarked on the cruiser H.M.S. *Amphion* to spend three days cruising among the pelagic sealing fleet to the south-west of the islands. They then sailed to Unalaska and on to Esquimalt and Victoria, British Columbia; thence to Ottawa, Boston, New York and Liverpool.

The diplomacy shown by D'Arcy Thompson in dealing with sealers, natives, Russians, the United States' Government, and fellow scientists resulted in a grateful British Government making him a Companion of the Bath in the New Year's honours list.

Back in Perth

In October 1897, after Alex Rodger's return to Perth, the Council of the Perthshire Society of Natural Science agreed to advance their (presumably

Plate 1

H.M.S. *Rainbow*

(I.S 748)

Plate 2

'Our House'
Glinka, Copper Island

(LS 699)

Plate 3

'Mine Exercise - Petropovlosk'
(Genuine practice or just fishing?)

(LS 684)

Plate 4

Killing Seals - St. George's Island

(LS 734)

Plate 5

Sleigh party - Bering Island

(LS 690)

Plate 6

H.M.S. *Linnet*

(LS 679)

penurious) Curator thirty pounds of his salary. At the opening of the Society's winter session, its President, Henry Coates, included the following in his address to the assembled members:

> "I think our first duty this evening is to congratulate our esteemed Curator, first, on having been selected by the Government to fill an important, though temporary, scientific post; and in the second place, on his safe return after fulfilling the duties of that post on the other side of the globe. The Society will, I am sure, be well compensated for the loss of his services during the five months of his absence, not only by the valuable, and in some cases almost unique, specimens which he has been able to bring home to our Museum, but also by the fund of experience which he has gained during his travels, and which will be used for the benefit of the Society" (Coates, 1898).

On 26th September 1897, Alex Rodger began to add to the Museum's accession book the specimens which he had brought back. The extensive list includes Fur Seal skeletons from St. Paul's, skulls of Sea Otters from Copper Island, Sable and Brown Bear skulls from Kamchatka, fishes, Paper and Pearly Nautilus and a giant crab from Japan, a Walrus jaw and tusk from Petropavlosk, and a collection of plants from Copper Island. Almost all of these specimens (the fishes and the plants do not seem to have survived) are present in the collections of Perth Museum and Art Gallery today. They provide a tangible reminder of this important and little-known expedition.

Notes on Sources

There are so few sources for this second Bering Sea expedition that a full reference list is inappropriate. The sources used in compiling this account were:

Coates, H. (1898). President's opening address, 11th November 1897. *Transactions and Proceedings of the Perthshire Society of Natural Science,* 2: cli.

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MARINE SAMPLING AND COLLECTING EQUIPMENT IN THE COLLECTIONS OF THE NATIONAL MUSEUMS OF SCOTLAND

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Introduction

This paper examines some items in the collections in the National Museums of Scotland, which are associated with the physical aspects of science of oceanography. In particular, it considers their provenance, which may be of importance for other scholars working in this field elsewhere. The National Museums of Scotland was formed in 1985, with the amalgamation of the National Museum of Antiquities of Scotland, founded in 1780, and the Royal Scottish Museum, which originated in 1854 (Anderson, 1989).

All the items in the National Museums of Scotland connected with 'Natural History and the Sea', the title of this conference, come from the collections of the former Royal Scottish Museum, and many of the hardware items - those which are now in the Department of Social and Technical History, and are the main focus of this paper - are currently to be found on display in the 'Instruments of Science' gallery on the second floor of the Royal Museum of Scotland (the principal display site, in Edinburgh), where they have been exhibited since 1986.

A smaller number of oceanographic items are held in the reserve collections, and there are large natural history and ethnographic collections deposited in other departments, the products of voyages of exploration (Sweet, 1974), and some manuscript material and photographs, deposited in our Library (Pitman, 1982). Among the collections held by the Museums are pieces of hardware associated with the collecting of biological specimens, the sampling of sea floor deposits, and the attempts to understand deep-sea temperatures and current systems.

Early Voyages

Voyages of exploration have been undertaken from Britain since Tudor times. The motives for them were usually more economic than scientific (Parry, 1963;

Deacon, 1971). However, along with the increasing interest in science during the late seventeenth century, travellers continued to bring back items of ethnographic or natural history interest, and soon special officers acting as naturalists, for whole expeditions, were being funded in part by scientific societies. The role of Joseph Banks on the first voyage of Captain James Cook (Beaglehole, 1974) and Charles Darwin's position on H.M.S. *Beagle,* are perhaps two of the more famous examples (Browne, 1995; Thomson, 1995).

By the late eighteenth century, the prime scientific purpose of these expeditions was to extend astronomical and geographical knowledge. During the nineteenth century, the most visible task of the Royal Navy was to keep open the extended sea-routes of the far-flung British Empire; but during the extended period of peace following the lengthy French wars, its main day-to-day tasks were the mapping, charting, sounding and exploring of the oceans. This continued well into the twentieth century, when even more of the global map was tinged with imperial pink.

The *Challenger* Expedition

Edinburgh's great contribution to oceanography came towards the end of the nineteenth century, although it had earlier roots: William Scoresby, Robert Jameson and Edward Forbes are perhaps the three figures who spring most readily to mind as pioneers of this then-infant science (Stamp and Stamp, 1976; Sweet, 1969; Wilson and Geikie, 1861). Dr. A.L. Rice has credited the mid-Victorian naturalist, W.B. Carpenter, as the chief instigator of the *Challenger* Expedition (Rice, 1986). By 1869, Carpenter was convinced through his personal participation in the recent successful voyages of the *Lightning* and the *Porcupine* that the British Government should fund a major scientific circumnavigation. Through his scientific contacts - he was a Vice-President of the Royal Society - and some personal political lobbying - he was acquainted with the Prime Minister, William Gladstone - he managed to raise the money and set up the structure for the expedition: he was perhaps assisted by a recognition by the Hydrographic Department of the pressing necessity of investigation of the ocean depths for submarine telegraphy.

The *Challenger* expedition, a joint venture between the Admiralty and the Royal Society, appointed as its scientific director Charles Wyville Thomson, Professor of Natural History at the University of Edinburgh, and Keeper of Natural History in the Edinburgh Museum of Science and Art (the precursor of the Royal Scottish Museum), who had gained zoological experience from earlier expeditions on the *Lightning* and the *Porcupine* Carpenter, by 1872 aged fifty-nine, was

Plate 1. Model of H.M.S. *Challenger*

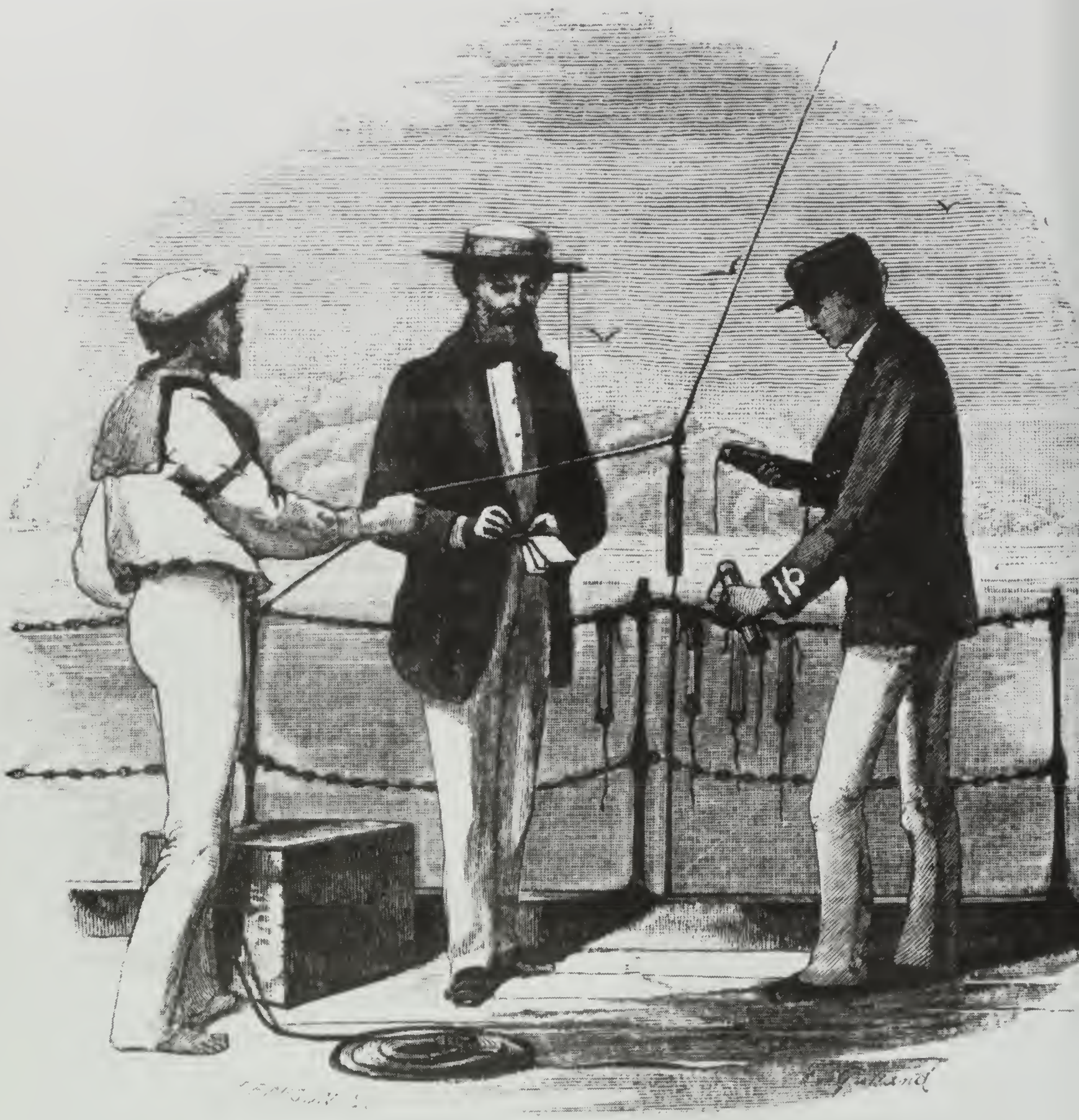

Plate 2

Reading Deep-Sea Thermometers

(From Thomson and Murray, 1885)

dissuaded from going to sea again. It is not necessary to do more here than outline *Challenger*'s achievements: with her scientific staff of six, besides the ship's officers and crew of 240, the wooden converted steam-assisted corvette covered 68,890 miles of the world's oceans between 1872 and 1876. Surveys were made, collections amassed, and magnetic and meteorological registers kept. On *Challenger*'s return, the scientific results were published in fifty volumes between 1880 and 1895. Altogether, 715 new genera and 4,417 new species were identified, and a mass of accumulated information about the physics, chemistry and geology of the land and sea was presented (Linklater, 1972).

For reasons which my colleague Mr. G.N. Swinney outlines later in this volume, the bulk of *Challenger*'s collections and equipment went elsewhere, although small numbers of natural history specimens from the voyage did find a home in Edinburgh, amongst them 171 duplicate Echinoderms, Tunicates, Crustacea and Sponges, which were presented by the British Museum (Natural History) in 1899 [registered nos. NMS.Z.1899.92.1-171]. Indeed, when the centenary exhibition of the great voyage was held in the Royal Scottish Museum in 1972 there was some difficulty in gathering material together: for instance, there was no contemporary model of the famous vessel herself, and one had to be commissioned (Plate 1) [NMS.T.1972.95] (Storer, 1985).

H.M.S. *Challenger* began life as a small warship. In fact, she was primarily a sailing ship with auxiliary steam power. She assisted in the British occupation of Vera Cruz in 1862, and later went on a punitive expedition to Fiji. However, she is best known for her 1872-1876 oceanographic expedition. Sixteen of *Challenger*'s eighteen 68-pounder guns were removed when she was refitted with laboratories constructed on the main deck. After her epic journey, her ocean-going life was almost over: she was commissioned as a Coast Guard and Drill ship of Naval Reserves at Harwich in July 1876, and was finally decommissioned at Chatham in 1878. In 1880 she was converted into a receiving hulk there, where she remained until being finally broken up in 1921 (Rice, 1986).

The main tasks of the scientific crew were depth sounding, temperature measurements at different depths (Plate 2), and dredge sampling, undertaken at various 'stations' (Plate 3). Dr. A.L. Rice has written:

> "By modern standards the voyage had been a rather leisurely affair, the vessel occupying some 362 official stations more or less uniformly distributed along the track so that in general a station would be worked every two or three days. The passages between stations were made almost entirely under sail, conserving the precious coal for station work when it was essential to maintain the ship's

Plate 3

The Dredging and Sounding Arrangements

on board the *Challenger*

(From Thomson, 1877)

position against wind and sea, particularly for obtaining accurate soundings. For towing nets across the sea-floor, however, neither sails nor engines were used, the ship simply being allowed to drift beam on to the sea" (Rice, 1986).

Oceanographic Equipment

Dr. Anita McConnell has observed in conversation that there is a major difference between oceanographic and other contemporary scientific instruments. Often lashed-up by the ship's blacksmith, these instruments lack the glamour of late Victorian brass-and-glass microscopes and telescopes; but more importantly, since they functioned by being thrown over the side of a vessel, they had a statistically-higher chance of being lost or destroyed. Perhaps this explains why there are few substantial collections of oceanographic equipment, containing even fewer items which were actually used on particular voyages. They were also often recycled, if they survived voyages intact, or cannibalised if not.

The largest collection, that of the Musée Océanographique in Monaco, is currently, and unfortunately, held in store. When the exhibits were set up in the early years of this century, under the instructions of Prince Albert of Monaco, to demonstrate the evolution of oceanographic equipment over time, the displays had perforce to use a number of replicas and models (Carpine, 1987-91-93-96-97-98). The second major collection is at the Science Museum in London, where a substantial proportion of this collection is on exhibition (McConnell, 1981 and 1982). At the National Museums of Scotland, the comparatively small displays attempt to explain Scotland's oceanographic interests by exhibiting the type of instruments used on the two major turn-of-the-century oceanographic voyages with which Edinburgh is associated.

In fact, of all the instruments held in the National Museums of Scotland to illustrate the *Challenger* voyage, the ones with the least tenuous connection are half-a-dozen Miller-Casella deep-sea thermometers with protective housings (Plate 4) [NPM.DU.111], which were amongst the thirty retested - many to destruction, hence their less-than-pristine condition - by P.G. Tait, Professor of Natural Philosophy at the University of Edinburgh after *Challenger*'s return (Plate 5) (Tait, 1882). In better condition is the example of a Miller-Casella deep-sea thermometer, presented to the Royal Scottish Museum in 1911 by the Admiralty [NMS.T.1911.59], but there is no indication where this example might have been used, if used at all. This form of pressure-resistant deep-sea thermometer had been devised in 1869 by Dr. W.A. Miller, in conjunction with the instrument makers Casella (Miller, 1869), in response to Wyville Thomson's dissatisfaction with the

Plate 4

One of six Miller-Casella deep-sea thermometers with protective housing, tested by Professor P.G. Tait after *Challenger*'s return

Plate 5

Professor P.G. Tait's apparatus for testing pressure errors in *Challenger*'s deep-sea thermometers

earlier bimetallic thermometer designed by Henry Johnson in 1861 [NMS.T.1935.17], which had proved to have only limited usefulness, and was erratic in its measurements (Glaisher, 1862; McConnell, 1982).

Subsequently, a new deep-sea self-registering thermometer was patented by the instrument makers Negretti & Zambra in 1874, which contained only mercury and had no indexes, unlike the previously used James Six thermometer. It was made in both straight and U-forms (McConnell, 1981 and 1982). Examples were sent for trials aboard H.M.S. *Challenger,* and when in 1875 her captain, George Nares, was detached from *Challenger* to lead the Arctic expedition in H.M.S. *Alert,* he took some of the new apparatus with him, including an example which is marked 'Polar Expedition 1875' [NMS.T.1911.62]: this also came to the Museum through the Admiralty in 1911.

Another link with the *Challenger* expedition is a hydrometer [NMS.T.1922.3], named the 'Buchanan' hydrometer after its inventor, J.Y. Buchanan, the chemist who was part of the scientific team aboard the vessel. It was used for measuring the specific gravity of sea water, in particular the salinity of samples, after they had been brought up in water bottles from particular depths. The hydrometer would have been used in conjunction with an accompanying thermometer (Buchanan, 1875). This particular example came from Dr. W.S. Bruce's Scottish Oceanographical Laboratory, after its closure in 1921. According to Wyville Thomson, *Challenger* was equipped with slip water-bottles, designed by the Edinburgh brass-founder James Milne (Thomson, 1877). During the voyage, J.Y. Buchanan devised another pattern of mid-water sampler from Milne's pattern, which was named the Buchanan stopcock water-bottle (Thomson, 1877). The example in the Museum's collection, also made by Milne of Edinburgh [NMS.T. 1930.30], is a subsequent development of this pattern, for which Buchanan developed a new release mechanism (Buchanan, 1893). It was given to the Museum in 1922 by J.C. Murray, son of one of the three naturalists on board *Challenger*. These were John Murray, H.N. Moseley, and Rudolf von Willemöes-Suhm. After Thomson's death in 1882, Murray was responsible for seeing the expedition's Scientific Reports through the press (Thomson and Murray, 1885), and became the leading figure in British oceanography until his death in 1913.

Early Problems

Before about 1850, there were problems connected with deep-sea sounding. Essentially, the use of a sinker heavy enough to carry a line down through several miles of water often caused the line to break when it was hauled up. Using a light lead and line made it difficult to tell when the bottom was reached, while the drag

of the water on the line tended to prevent the lead reaching the bottom at all. Unless a sample was recovered, as with sounders which incorporated a scoop, there was no proof that the bottom had been reached. Furthermore, it was likely that the line played out greatly exceeded the vertical distance between surface and sea bed. The example of a sinker in the Museum's collection [NMS.T.1922.24] was also presented by John C. Murray in 1922 from his late father's collections, but without any information as to which expedition it might have been used on, if any.

In 1868, the ship's blacksmith aboard H.M.S. *Hydra* developed a new form of sounder, which was used in surveying along the proposed Red Sea cable route. In this design, a spring jettisoned the sounder weights at the sea bed (Shortland, 1869). The *Hydra* sounder was an improvement on previous designs because the weights drove the sampler deep into the sediment before they were thrown off. The *Challenger* was supplied with a number of these at the start of her voyage, and in 1873 twelve of the new Baillie sounders were sent out to *Challenger,* and were also used with sinker weights: even with 3.0 cwt of sinkers it could still take well over an hour for the Baillie sounder to reach the bottom in 4,000 fathoms. The Buchanan sounding tube was devised by J.Y. Buchanan after *Challenger*'s return, and combined a central sampler tube with a jacket, which captured a water sample as the tube was lifted from the sea bed (Buchanan, 1880). There are examples of the three types of sounder described above in the National Museums of Scotland: the *Hydra* and Baillie examples [NMS.T.1918.6; NMS.T.1977.111 and 113] were presented by the Admiralty, and thus probably came from stock which was never issued to an expedition, while the Buchanan sounding tube [NMS.T.1921.66] came from Bruce's Scottish Oceanographical Laboratory.

W.S. Bruce

The close associations of Edinburgh with the *Challenger* expedition turned the attention of William Spiers Bruce (1867-1921) to the sea and exploration. He went to the University of Edinburgh to read medicine, but did not graduate. In 1892-1893 he sailed as ship's surgeon in the Dundee whaler *Balaena* for the South Shetlands (between the Falkland Islands and Antarctica) where he undertook zoological research and also discovered the first evidence of the Antarctica anticyclone. After fruitless attempts to raise funds for the exploration of South Georgia, he took charge of the Ben Nevis Meteorological Observatory in 1895, but left the following year to pursue biological research on an expedition to Franz Joseph Land (Brown, 1923; Pitman, 1982).

Over the next few years Bruce went on a number of expeditions, gaining experience in polar work, and in 1900 he announced his plans for a Scottish

National Antarctic expedition to explore the Weddell Sea. Funds were raised in Scotland, and the *Scotia*, a converted Norwegian whaler, left the Clyde in November 1902 (Rice, 1986). The *Scotia* spent two summers in oceanographic work in the Weddell Sea and the South Atlantic, returning to Scotland in July 1904 with large biological collections, from depths as great as 2,900 fathoms, and voluminous hydrographical and meteorological observations (Three of the Staff, 1906).

The results of the expedition were published in seven volumes, but the series was left incomplete because of lack of funds. Bruce went on several other polar expeditions, and in 1907 founded the Scottish Oceanographical Laboratory, hoping that it would expand to become a great institute of oceanography comparable to that of Monaco. The laboratory was located next door to the Royal College of Surgeons of Edinburgh, and the remains of the building can still be seen today. Bruce undertook the burden of the Laboratory's upkeep, but failing health and lack of money compelled him to abandon the scheme in 1920. The bulk of the natural history specimens, and much of the residue of the physical apparatus of the Scottish Oceanographical Laboratory, came to the Royal Scottish Museum the following year, but just how much of the hardware was actually used at sea is unclear. Other natural history specimens were presented to museums in Aberdeen, Glasgow, Paisley, Perth and Dundee, while the University of Edinburgh and the Royal Scottish Geographical Society received manuscript material, maps and photographs (Pitman, 1982).

The Adelie Penguin *Pygoscelis adeliae* [NMS.Z.1921.143.53] which was brought back amongst the *Scotia*'s specimens, and the famous photograph of the piper with the penguin, are perhaps among the more memorable items connected with the Scottish Antarctic Expedition of 1902-1904: both are displayed on the 'Instruments of Science' gallery in the National Museums of Scotland. In the Department of Geology and Zoology, a cast of the Sunfish which was originally displayed in the Scottish Oceanographical Laboratory is currently to be found in the 'Fish' gallery, while a massive Sea Lion, in due course also destined for the Museum, was shot one evening in the Falklands Islands. It measures 10 feet 8 inches, and weighted 1,200 lbs. "With our prize safe ...," wrote Rudmose Brown:

> "...we now set out on our return journey, when, true to its wonted habit, the wind failed entirely at sunset, and we were becalmed six miles from the *Scotia*. There was no likelihood of a breeze springing up, so we had to make shift to row [the small boat] home... At barely a knot an hour we crept onwards, working like galley-slaves; and it was after midnight when [we] reached our anchorage" (Three of the Staff, 1906).

Other Exhibits

Less dramatic display items are two thermometers, one mercury (Plate 6) and one spirit (Plate 7), both constructed by the London firm Negretti & Zambra, presented by W.S. Bruce [NMS.T.1921.49 and 50]. It can be seen from the photographs of apparatus on board the vessel, illustrated in the published accounts of the voyage, that many of the items in the Museum's collections are of the same pattern, if not the same instruments themselves (Brown *et al.*, 1906). We continue to collect items associated with oceanographic expeditions when they become available: a sextant, acquired in 1981, was originally retailed in Liverpool, and has a note in it to say that it was used by Jock Fitchie, mate when the *Scotia* went to South Polar regions on the Scottish National Antarctic Expedition 1902-1904 [NMS.T.1981.59]. Perhaps the single item we have which must actually have been used for collecting biological marine samples is a small dredge net: an extremely unusual survival, it was found, without its documentation, within the Museum during my curatorial lifetime [NMS.T.1991.X1]. It can only be surmised that it, like so many of the other items of oceanographic apparatus in the National Museums, came from Bruce's Scottish Oceanographical Laboratory after its closure in 1921.

Acknowledgements

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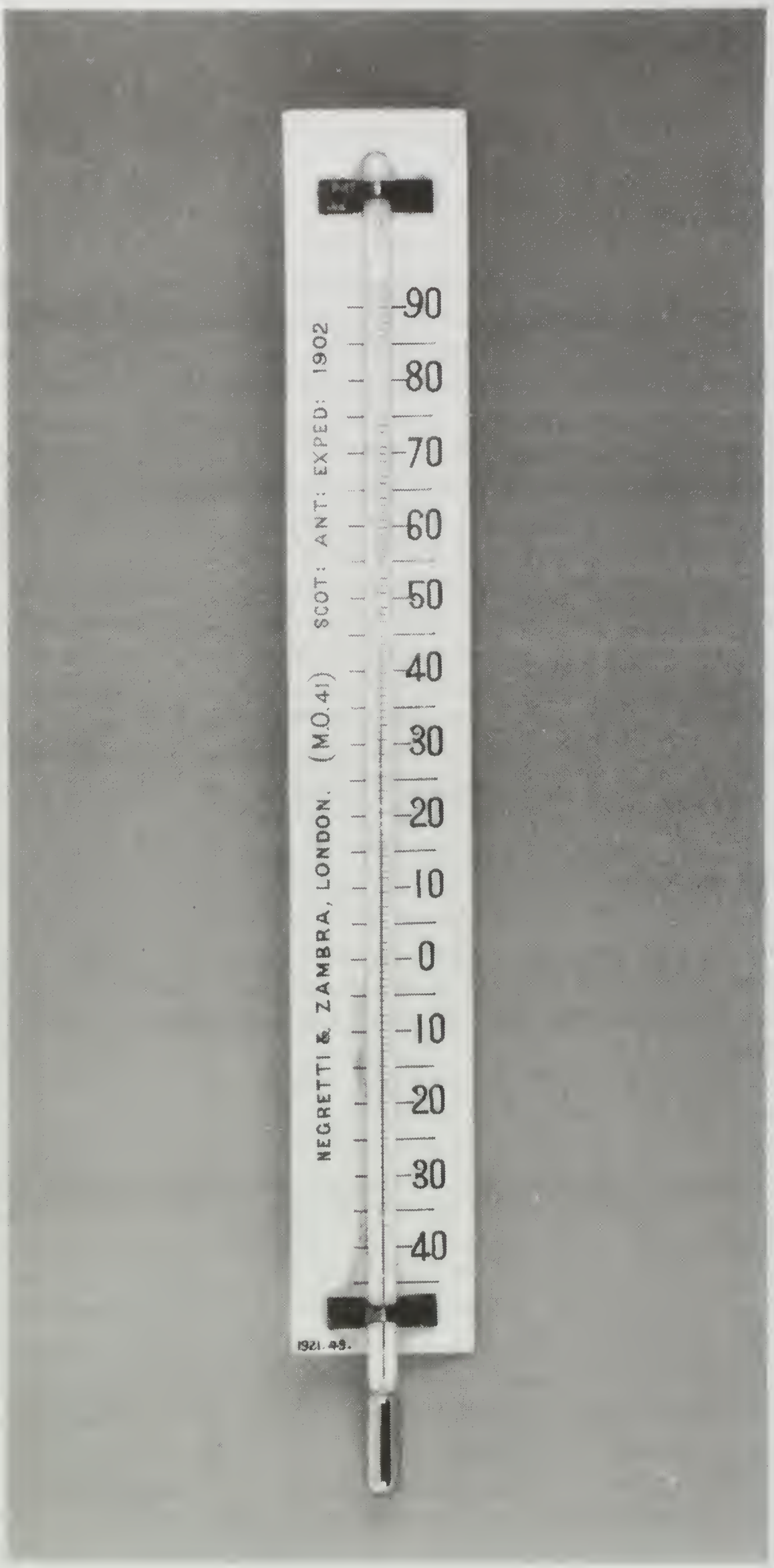

Plate 6

Mercury Thermometer, made by Negretti & Zambra, London
Marked: (M.O.41) SCOT: ANT: EXPED: 1902

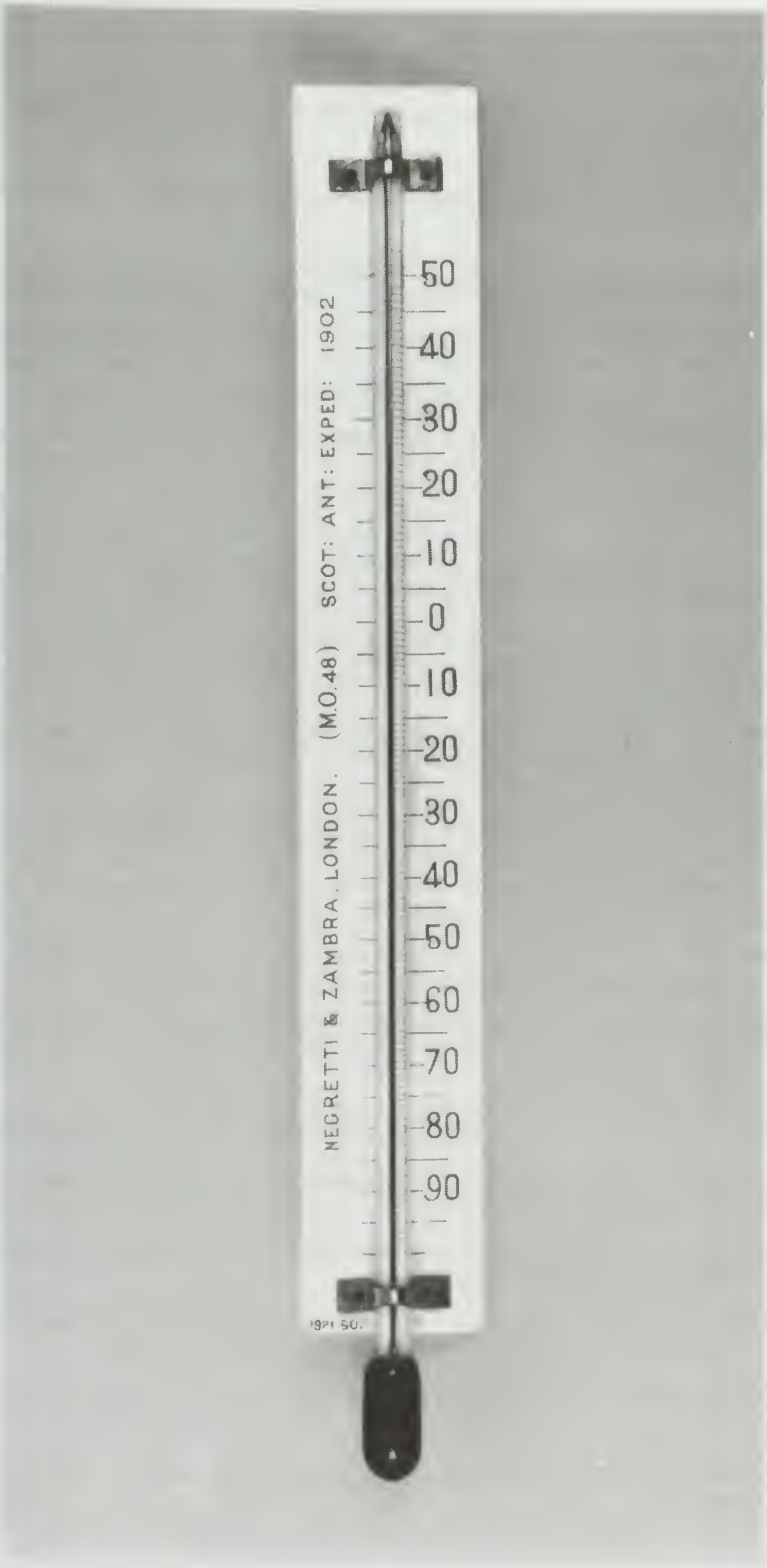

Plate 7

Spirit Thermometer, made by Negretti & Zambra, London
Marked: (M.O.48) SCOT: ANT: EXPED: 1902

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MARINE SCIENCE IN THE CORRESPONDENCE OF JAMES HUTTON AND JOSEPH BLACK

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ABSTRACT

The correspondence of the chemist Joseph Black (1728-90) and that of his close friend, the geologist James Hutton (1726-97), both contain some references to marine science. For example, one of Black's former pupils wrote from Granada with theories about waterspouts and the effect of the ocean on climate; and a cousin, who was a naval captain, sought an explanation for the speed with which iron nails rusted in copper-bottomed ships. Hutton instructed Joseph Banks, and his Scottish travelling companion James Lind, about the way ocean temperatures should be recorded. Hutton also encouraged a merchant who was voyaging to Labrador to take readings with different thermometers so that the instruments could be compared (Jones, 1983).

These references are interesting not only in themselves, and for what they show about the difficulty of getting accurate instruments, but also as an example of the network of contacts within the intellectual community at the time.

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THE SCOTTISH NATIONAL ANTARCTIC EXPEDITION

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Introduction

On 2nd November 1902 the sailing yacht *Scotia* sailed from Troon for the Antarctic at the beginning of the Scottish National Antarctic Expedition - the *Scotia* Expedition. Being the Sabbath, few people saw her sail, and even on so proud and memorable occasion as this, one national newspaper wrote of the event:

> ...stands Scotland where she did, when a ship can sail on the Sabbath with pipes playing and people singing not psalms but profane songs such as "Auld lang syne" (Three of the Staff, 1906).

This contrasted markedly with the scenes in London the previous year, when thousands gathered and cheered the departure of the *Discovery* and Captain Robert Falcon Scott also heading for the Antarctic. Despite the lack of publicity, the *Scotia* expedition has been described, in terms of its discoveries and achievements, as one of the most ambitious ventures of its time. While scientifically an unreserved success, the expedition has never achieved the public acclaim it justly deserved. Even today, over 90 years on, the scientific results are amongst the most detailed undertaken in that region of the Antarctic - the Weddell Sea.

Public Recognition

Why then did it fail to achieve such public recognition? In school we read of other explorers, both Scots and non-Scots, but never of William Speirs Bruce (1867-1921), the leader of the Scottish National Antarctic Expedition. Yet here was an explorer who stands as high, if not higher, in the realms of polar exploration than many of his better known contemporaries. One need not look far to find the reason for this lack of public recognition. Firstly, it was purely a scientific expedition, making no pretence of even a token attempt to reach the South Pole - an idea which, following the announcement of the plans for Scott's British National Antarctic Expedition, had gripped the hearts of the wider British people. Secondly, Bruce, the leader, was essentially a shy man and was first and foremost a scientist, who did not strive for the glamour of publicity or even try to

sell the expedition to the media; his sole interest was in the science of polar regions - such tasks as public lectures he looked upon as necessary evils. The narrative of the voyage, usually written by the leader, was in this instance produced by three of the scientific staff (1906). In consequence, the *Scotia* expedition has been overshadowed by most of the polar expeditions of the early part of this century, in particular those of Amudsen, Shackleton and Scott, whose heroic, and sometimes tragic, efforts to reach the South Pole are well known in both book and film. Bruce, however, can stand in his own right at the forefront of polar exploration. Between 1892 and 1920 he took part in no less than thirteen expeditions to both the Arctic and Antarctic, during which time he became an internationally respected authority on many aspects of polar life.

W.S. Bruce

Born in London on 1st August 1867, of Scottish parents, the elder son in a family of six, Bruce became an ardent Scot, and a true nationalist. During his early years, he showed little of the qualities one would expect from someone destined to become a great explorer. Somewhat timid, he was a serious-minded youth with a strong aptitude for study and a flair for natural history. It was assumed that he would follow in his father's footsteps and enter the medical profession. At the age of 17 he visited Scotland for the first time, and decided that here would be his future home. He entered Edinburgh University to read medicine, and while there developed his interests in zoology and oceanography.

First Voyage

In 1892, Bruce accepted an invitation to voyage to the Antarctic as surgeon on the *Balaena*, one of four whaling vessels sailing out of Dundee to investigate the possibilities of exploiting the rich whale stocks of the southern oceans. Despite the very cramped conditions on board, he successfully undertook regular and valuable scientific observations throughout the voyage. This whetted his appetite for polar exploration.

By the time of his return home, Bruce was convinced that Scotland should mount her own national expedition to the Antarctic. Since this would require careful organisation, it could not be undertaken for some considerable time. While formulating his plans, he busied himself for the next few years working in the Arctic, where he met and was befriended by the Prince of Monaco (at that time a great patron of the sciences) and Andrew Coats of the famous Paisley industrial family; two friends who were to do much to help Bruce achieve his ideal.

Preparations for the *Scotia* Expedition

Towards the end of the 19th century, Bruce, already a respected and established authority on polar sciences, was invited to sail with Scott on the *Discovery* expedition, but this he declined, having by that time nearly completed plans for his own venture. These proposals, announced by Sir John Murray to a meeting of the Scottish Geographical Society on 22nd March 1900, were well received by the scientific community both at home and abroad.

As with all such undertakings, the major problem was the raising of sufficient capital to successfully mount the venture, a cause made all the more acute because of the British Government's refusal to make any financial commitment towards the costs. In fact, throughout the planning, undertaking and subsequent writing up of the scientific results, the Government was conspicuous by its lack of financial support. This was in marked contrast to the tens of thousands of pounds which were given to the expeditions of Scott and Shackleton. A fund was opened and, although there was a steady inflow of money, it was not sufficient to guarantee the expected costs. Bruce's friends from his Arctic days generously supported the cause - Andrew Coats donated £5,000 and James Coats £6,000.

The initial programme was for a three-year voyage to the Weddell Sea and South Atlantic Ocean, but the lack of money vastly changed the time scale. It had been hoped that a party of seven men would spend at least one winter in as high a southerly latitude as could safely be reached, possibly on the Antarctic continent. There they would undertake their own work programme, releasing the ship to carry out research on the oceanography of the Weddell Sea. Oceanography and meteorology were the main sciences of the expedition, but where possible, biology, geology and mapping of land would be carried out. It was an ambitious plan, working in an area of ocean previously visited by very few expeditions and whose observations had raised several still unanswered questions. Lack of money, however, vastly changed the time scale.

Proposed Investigations

At the turn of the century, little was known about the oceans of the high southern latitudes. Although both James Cook and James Weddell had sounded the depths of the Weddell Sea, no expedition had carried out detailed systematic studies of the region. While surveying these waters, it was envisaged that the vessel would operate at selected stations - there the ocean depth would be sounded and a sample of the seabed collected for later analysis; at various depths, the sea temperature would be recorded, and water samples taken to determine its chemical

composition. Several types of nets and trawls would be carried on board, thus allowing collections to be made of the rich life at various depths in the Antarctic waters. For this, the ship would be equipped with the most up-to-date apparatus available.

During the two years he had spent at the observatory on the summit of Ben Nevis, Bruce had developed a passion for meteorology. Throughout the Antarctic cruise, and in the winter quarters, weather observations would be made every hour.

The most important purchase was a suitable vessel. The ship had to be wooden, of immense strength to withstand the pressures of the ice which would undoubtedly be encountered, and powerful enough to push her way through the pack ice. As well as being good in ice, the vessel would have to be a safe sea-boat, of sufficient size to carry the expedition's stores, with ample living space for the personnel, but small enough to get close inshore along the Antarctic coasts to find suitable safe anchorages.

Bruce's original choice was the *Balaena*, in which he had already sailed to the Antarctic in 1892, but this proved to be too costly. It was necessary to go to Norway, where he bought the *Helka*, an old whaler, for £2,620. The ship sailed across the North Sea, but only when she was dry docked in the Ailsa Shipbuilding Company yard on the Clyde did the full extent of the necessary repairs become apparent, e.g. much of the hull timbers had to be replaced. It was estimated that a further £3,000 was needed to make her sea-worthy. By August 1902, the necessary repairs had been completed, and, renamed *Scotia*, she had successfully completed sea trials.

The *Scotia*

With the strength of a whaler, but the lines of a yacht, *Scotia* has been described as the most graceful ship to sail to the Antarctic (Plate 1); she was a barque-rigged, auxiliary screwed steamer, with a registered tonnage of 238, 140 feet long, 29 feet at the beam, and a draught of 15 feet. The outer hull, from bilge to keel, was protected by several layers of wood, and as an additional precaution against ice abrasion there was, from above the water-line to near the keel, a 2-3 inch layer of greenheart - a very hard wood widely used on ships sailing to the Arctic, and well known to withstand the extensive rubbing it was likely to experience from the ice. The hull itself was a massive structure, with a minimum thickness of twenty inches. The solid timber of the bows measured nearly nine feet. Although basically a sailing vessel, *Scotia* was equipped with a 55 h.p. coal-fired engine, giving her a potential speed of eight knots.

Plate 1

Scotia

The Crew

As with the ship, Bruce was equally careful in selecting the officers, crew and scientific staff, having whenever possible a preference for those he either knew or had previous experience of whaling. They had to be compatible, being able to live together in the cramped hazardous conditions likely to be experienced during the expedition. Bruce was fortunate in his choice of master. Thomas Robertson, a native of Peterhead, was, at 48, not only one of the most experienced whaling skippers of the period, but he also had a genuine interest in both exploration and geography. 'Caffy Tam', as he was known to his crews, had already experienced 23 summer seasons in polar regions, including one to the Antarctic - having sailed as captain of one of the four whaling-ships with which Bruce had voyaged in 1892. The three mates, two engineers, and all but two of the crew, had either sailed with or were known personally to Robertson. Thus Bruce collected around him a crew well versed in seamanship and familiar with handling small boats in ice-strewn waters.

Scientific Staff

Including the leader, the scientific staff numbered eight. Walton, with Arctic experience and well versed in polar travel, was in charge of vertebrate biology. Mossman, the senior meteorologist, had worked at the observatory on Ben Nevis. Dr. Harvie Pirie was medical officer and geologist. Rudmose Brown the botanist, like Walton, had spent time in the Arctic. Three assistants made up the scientific staff.

Bruce was also careful in selecting equipment, seeking expert advice whenever possible. While in Norway, he visited the explorer Nansen, and discussed with him the type of gear he would need for living and travelling in such a hostile environment. Like the staff, the equipment was well proven and the best available.

Finance

Immediately prior to sailing, the expedition was in dire financial straits, with insufficient funds to pay the salaries of the scientists while in the Antarctic. Such was the scientific staff's loyalty to Bruce that all were prepared to carry on unpaid, but a further generous donation by the Coats family made this sacrifice unnecessary, and also ensured that the research would extend into a second summer season.

The expedition was run on a shoestring budget, costing in all only £36,500, of which the Coats family was to donate nearly £30,000. This compares with an

estimated £250,000 which the contemporary British Antarctic Expedition cost, with a large proportion of the latter being met from the British Government's exchequer.

Cooperation with other Expeditions

During the period of the Scottish voyage (1902-1904), three other national expeditions would be working in the Antarctic - a British under Scott, a German led by Professor von Drygalski, and a Swedish one led by Dr. Otto Nordenskjold. Realising the need for the standardisation of scientific observations, particularly the collection of meteorological records, Bruce visited these leaders to discuss their plans and arrange, wherever possible, for similar data to be collected in a standard way. Since the Swedes and Scots were operating in adjacent regions of the Antarctic - the Weddell Sea and Antarctic Peninsula - the two leaders agreed that, in the event of either getting into difficulties, the other would eventually come to their aid. This was a necessary precaution, because neither expedition had the funds available to purchase, equip and send a relief vessel to search for them should the need arise. As events transpired, this promise nearly had to be fulfilled.

Final Preparations

Throughout the summer, *Scotia* lying at Troon was the scene of hectic operations. Stores and equipment kept arriving, and all had to be carefully stowed in the hold so that they were readily accessible as and when necessary. As sailing day approached, the question on everyone's lips was would the expedition leave on time. The official date announced to the press was 25th October 1902, but it was to be a further week before the expedition finally left Scotland's shores, on 2nd November.

After calling at Ireland, the vessel headed south, experiencing en route a period of bad weather, which laid low many of the scientists with sea-sickness and loosened some equipment which had to be re-stowed and tied down.

The scientific programme was quickly started, and equipment tested. Surface trawling was experimented with, and some interesting material collected. (This included a large Sunfish, now in the National Museums of Scotland, Edinburgh).

The Voyage

Despite the rough seas, *Scotia* handled easily; the engine was well tested during this time and a good average speed maintained. On 6th January 1903, 7,000 miles and just over two months after leaving Scotland, the ship anchored off

Stanley, in the Falkland Islands. To many on board, these wind-swept and barren islands, with the smell of peat smoke hanging in the air, reminded them of the west coasts of home. During the next three weeks, the expedition remained in the Falklands and the scientists took every opportunity to travel, collecting animals, including twelve species of birds, plants and rocks to add to the scientific knowledge of the islands. All were well entertained by the Governor of the colony, the local population (a large proportion of which were of Scots descent), and the ships of the Royal Navy's South Atlantic Squadron.

Leaving the Falklands, the *Scotia*'s decks were laden with additional cargo generously donated by the Islanders. The summer was now well advanced, and it was imperative that the expedition sail south with all speed. For the first two days the weather was dry and fair, with a heavy cross swell. The ship, now sitting low in the water, rolled steeply, up to 40° being recorded on the clinometer. A falling barometer heralded the approach of bad weather, and by the third day *Scotia* was in the teeth of a 'roaring forties' gale - Cape Horn greybeards towered high above the ship, sending green water crashing onto the decks. Part of the weather bulk head stove in, and some deck cargo was lost overboard. The vessel handled well, however, and little flooding was actually experienced.

It was during this gale that the first iceberg was sighted, and, as the voyage progressed, more and more were seen, with individuals measuring over 100 metres in length and 40 metres high becoming a common sight. On several occasions, avoiding action had to be taken, as these huge white shapes suddenly materialised out of the polar mists. Also of great danger were the smaller pieces of ice known as 'growlers'; these were very difficult see, especially in rough seas, and could easily badly damage and hole the ship should they make contact.

Oceanographic soundings started on 1st February 1903 and became a daily feature of the cruise. These, coupled with the hourly meteorological observations, kept all the scientists busy. On the following day, *Scotia* had her first encounter with, and successfully navigated through, pack ice. Meeting this ice so far north and so late in the season was unexpected, since previous expeditions had not encountered these conditions until much further south. It did not augur well for the rest of the summer.

Antarctica

On 3rd February land was sighted and, although time was short, a boat was put ashore on Saddle island, a small island in the South Orkney Island group. Scientific collections were made, a record of the expedition's results to date left

behind, and the explorers had their first close encounters with the local wildlife, Chinstrap Penguins and Sheathbills.

From Saddle Island, Bruce hoped to sail directly south into the Weddell Sea, but his route was barred by heavy pack ice, which the vessel could not penetrate. Using up valuable supplies of coal, Captain Robertson was forced to sail eastwards along the ice edge towards the South Sandwich Islands. Although there was by now a pressing need for speed and to find a way south, Bruce insisted that the scientific programme be continued. It was during these early days that the first major discovery of the expedition was made. Soundings of the sea-bed showed the existence of a previously unknown submarine ridge lying between the South Orkney and South Sandwich Islands. Named the Scotia Ridge, it has since been shown to run from the tip of South America, eastwards to the South Sandwich Islands, then south and west surfacing at the South Orkney and South Shetland Islands and ending up on the Antarctic Peninsula.

It was not until 15th February that a suitable southward lead was found. Once a southerly course was set, *Scotia* made good speed, crossing the Antarctic Circle and reaching a latitude of 69° 39' S before once again pack ice was encountered. Afraid that the ship might become held fast in the ice, Robertson advised against pushing into it. Bruce readily agreed with his captain, and the vessel continued cruising on an easterly bearing, pushing south as and when ice would permit. On 25th February the season's farthest south was reached (latitude 70° 25' S). On the same day, the ship's log reported a strong appearance of land to the northeast, but this was thought improbable.

By now it was clear to both Bruce and Robertson that it would not be possible to spend the winter ashore in the high southerly latitude as originally envisaged. They decided instead to turn north and set up winter quarters on the South Orkney Islands. Their passage north was not without incident, having to use up large quantities of the coal reserves as the ship battled with the ice. Regularly she was beset, only for the wind to change, or the swell to rise, the ice to shift, and *Scotia* once again became free.

On 21st March, Cape Dundas on Laurie Island was sighted. Being the equinox, the weather was particularly bad and high seas were running. Careful navigation was essential, and it was not until four days later that the ship finally anchored in what was named Scotia Bay. It had been Bruce's intention that, once the winter's quarters were established, *Scotia* would return to sea and complete an early winter cruise, but shortly after their arrival, the sea froze over, and the vessel became held fast in the ice until the following spring (Plate 2).

Laurie Island, the second largest of South Orkneys, a rugged mountainous group, lies between latitude 60° and 61° S and longitude 44° to 47° W. Although in a similar latitude to the Shetlands in north Scotland, these islands are not in the path of a warming current comparable with the Gulf Stream, and are consequently much colder and more desolate.

Earlier Visits

Prior to the *Scotia*'s visit, little was known about the archipelago. The islands were first sighted on 5th January 1821 by George Powell in the *Dove,* while searching for new Fur Seal breeding grounds. Powell sailed along the north coast of the largest island, which he named Coronation Island, and as far east as Laurie Island. He did not, however, map the latter, and his chart of the area, published in 1822, shows only Laurie Island's western shore.

In the following year, James Weddell, sailing out of Leith in the brig *Jane*, and ignorant of Powell's discoveries, visited the islands and drew up a rough chart of the group, naming the most easterly point of Laurie island, Cape Dundas. Sixteen years later, the great French explorer Dumont d'Urville also surveyed the north coast of the islands. From then until the beginning of the present century, few others visited the group.

All these early expeditions remarked on the desolate appearance of the region, where the mountains rise sharply from the sea to a height of over 1,000 metres (on Coronation Island). Glaciers abound around the coasts, safe anchorages and landing places are few. Lying in the path of the cold water current from Weddell Sea, they experience a climate far colder than many places farther south. The seas around the islands can freeze for up to eight months a year, making access by ship during this time impossible. Here then was the place Bruce decided to establish his winter quarters.

Winter Quarters

Scotia Bay, where the vessel lay at anchor, opens widely to the south, narrowing at its head. Unlike most of the land in the group, the landing beach is low-lying before opening again to the north into Jessie Bay. The eastern and western extremities of the beach are flanked by low mountains and glacier piedmonts.

Once the winter quarters had been reached, with the *Scotia* stuck fast in the ice one of Bruce's first objectives was to build a hut ashore. This would serve two

Plate 2

Scotia

Held fast in the ice, Scotia Bay, Laurie Island.
March 1903.

functions; first as a land-based meteorological station, and second, in the event of the loss of the ship during the winter, for use as a rather cramped, but adequate refuge. Although the expedition carried no building material, the leader was undeterred and resorted to the traditional old Scottish method of wall building - 'dry staining'. Boulders were dug from the glacier moraines and the beaches, and as the walls rose, the gaps between the stones were filled with rubble and sand. The result was a hut measuring 14 feet by 14 feet, with walls 3.0 feet thick, roofed and lined with canvass (Plate 3). Wood from packing cases was used to build furniture.

Daily Routine

A daily routine was quickly established. Breakfast was at eight in the morning, day working starting half an hour later. On most mornings, one of the scientists, assisted by members of the crew, would go onto the ice and collect the traps from the sea bed, or haul in the dredge nets which had been lowered into the sea through a hole in the ice. Despite being usually hauled over the same area of seabed throughout the winter, the net rarely failed to gather a rich and varied fauna. These samples, once sorted, were labelled and stored, to be later compared with collections from other Antarctic regions. Marine animals and plants, some never seen before, were regularly hauled up from the seabed.

Regardless of the weather, this daily programme continued throughout the winter, and all on board took an active interest in what was collected.

During March and early April, seals and penguins still visited the island. As well as being of scientific interest, they were also to augment the food supply as fresh meat. With the shortening day length, these animals were seen less frequently and by the end of April had all but disappeared from the shores.

The hourly meteorological observations were continued throughout the winter months, and half-hourly tidal observations were started.

Lunch was served at 12.20 p.m. and outside work continued in the afternoon until the light failed. Tea was taken at 4.0 o'clock, and dinner, a substantial meal, which at least three times a week consisted of fresh meat, was at 6.0 p.m. After this, with the exception of those on watch, all were free to do whatever they wished. Most evenings were spent reading, repairing clothes, playing cards, telling stories and occasionally having sing-songs. The gramophone was well used, and proved to be a great success.

The daily routine was broken only on Sundays, and on special occasions such as birthdays and anniversaries when a toast or two were drunk. Rudmose Brown, in

Plate 3

Winter Quarters

The shore hut, Scotia Bay, Laurie Island.
(Note the dry-stane dyking).

his biography of Bruce (Brown, 1923), recounts that any anniversary could prove an excuse for a celebration, be it the date of the Battle of Waterloo or someone's second or even third birthday of the winter! As with all polar expeditions, the highlight of the winter period was mid-winter's day - the time when the sun reaches its zenith in the north and starts its journey back to the southern hemisphere. A holiday was declared, with only routine work being undertaken, and a special dinner was prepared. In the wardroom, while the officers partook of their after-dinner port, the crew broached one of the two barrels of porter kindly donated to the expedition by Messrs Guinness of Dublin. Soon sounds of revelry came from the foc'sle, no one having realised that in these sub-zero temperatures the water in the beer had frozen, leaving only strong spirit to be drunk by the glassful.

Winter Activities

Throughout the winter, Bruce kept all the staff active; they were encouraged to take regular exercise around the cove and skiing classes were popular. The result was no serious case of anxiety or depression. The climate was harsh, but healthy and few suffered serious illness. Allan Ramsay, the chief engineer, however, was the exception. As early as the Falklands, he developed what was later to prove to be heart trouble. Rather than quit the expedition in Stanley to return home, leaving the ship without an engineer, he had insisted on staying. Since March, he had spent most of his days sitting in a chair near the wardroom stove. Bruce thought that he might just survive the winter, but in early August his condition deteriorated rapidly and on 6th August 1903 he died. Two days later, his body, draped in the gold and red Scottish national standard, was sledged ashore. It was a sad and melancholy occasion, as to the sound of 'The Old Hundred' and 'The Flowers o' the Forest', played by Piper Gilbert Kerr on the bagpipes, he was buried on the north shore of the bay - "the side nearest home" (Three of the Staff, 1906).

By late August the days were getting longer, and although temperatures were still relatively low, Bruce decided it was time to start the detailed mapping and exploration of the island. Several small groups left the confines of the cove, to visit various lands nearby. These trips were fraught by periods of bad weather, high winds and low clouds. Sudden changes in temperature could cause equally sudden changes in snow conditions, so affecting travelling. In such conditions, work was well-nigh impossible, there being little else to do but crawl into tents and lie up until conditions improved. Whenever the weather cleared, someone would leave the tent to read the series of angles for the peaks and headlands which were visible. In addition to these surveys, a series of soundings of the bay were made. These were taken through holes in the ice, and had their own problems as the sea ice became thin and unsafe. During these ventures from the ship, Bruce's intimate

knowledge of the polar environment and weather proved invaluable, his timely interventions saving several members of the expedition from getting themselves into potentially dangerous situations.

Despite the precautions taken, some of those in the field developed snow blindness, and on one occasion, a combination of this and bad weather held up a party for so long that they returned to the ship only hours before the ice, upon which they had been travelling, blew out to sea.

Throughout the winter months, animal life was scarce. With the exception of the comical Sheathbill, a constant winter companion, which fed on any food scraps, only occasional birds and seals were seen. As the long winter drew to a close, so the wildlife began to return. As early as August, female Weddell Seals hauled out onto the sea ice. There, often in temperatures well below zero and in gale force winds, their pups were born. In early September, Adelie Penguins were again seen; initially as the occasional straggler, but by the end of the month the breeding colonies around the base were crowded and noisy with hundreds of thousands of these birds. A few weeks after the appearance of the Adelies, Chinstrap Penguins returned, also in their thousands. The large Giant Petrels began to spend longer and longer at their nests as the breeding season approached, while the pure white Snow Petrels and the brown and white dappled Cape Pigeons reoccupied their nests on the high bluffs near the base. The silence of the winter was broken by the harsh cries of the birds as they squabbled and displayed with each other, establishing their breeding sites. At last a feeling of the coming summer began to prevail on the base camp.

Summer Activities

The sea ice, particularly to the north, was showing signs of breaking up, and in early October, when open water appeared along this shore, Bruce decided to carry out a detailed survey of the coast using the ship's small boat and sledge. Much valuable work was completed, as more and more Scottish names began to appear on the map. The experience was enjoyed by all, each day bringing its own new and exciting discoveries, be it a colony of birds, new fossils, or just the sheer beauty and colour of the scenery. While Bruce and his companions were away from base, the ice in Scotia Bay finally broke out, and, on 25th November 1903, *Scotia* was again afloat. The plans for a return to sea had long been made, and after picking up the north coast party, ensuring that those remaining behind for the summer had sufficient supplies for the rest of the season, the ship sailed for the Falkland Islands.

Six men, including James Mossman who was in charge, stayed behind to maintain the meteorological programme, and to carry out what biological,

geological, glaciological and survey work they could. Even with only six, conditions in the small hut were cramped. The sleeping arrangements allowed for four hammocks and two bunk beds. One corner was the kitchen, and another served as the washing area. From the stove, wires ran out to the four walls and on these wet clothing was always hanging up to dry. When the day's work was finished, the men tended to gather round the fire for a smoke and talk before turning in, leaving only the night watchman awake to keep a vigil on the hut and to carry out the night observations.

During regular excursions to the nearby penguin colonies, the first detailed observations on these peculiar birds were made. Three species were breeding on the island. The Adelies laid their eggs in late October, followed shortly afterwards by the Gentoos, and in about another three weeks, towards the end of November, the Chinstraps began to lay. From counts made around the island and on the offshore stacks, it was estimated that the total breeding population of penguins was five million.

On 2nd December 1903, while expedition members were scrambling on the bluffs near the base camp, the first egg of the Cape Pigeon was found (now in the National Museums of Scotland, Edinburgh). This seabird, a member of the petrel family, had been known to travellers in the Southern Oceans for over a hundred years, but until now no-one knew where it bred.

As summer progressed, the temperatures remained above freezing and the snows on the beach melted. With the retreating of the ice, the wall of the hut facing the sea was found to have no foundation; utilising the readily available supply of boulders and sand on the shore, this was quickly attended to. Water poured off the glaciers, and the snow cover disappeared, exposing crevasses and making travelling more dangerous.

Christmas and New Year were celebrated. Despite the cramped conditions, Smith, acting as cook, produced a splendid festive dinner.

The menu was:

Tomato Soup
Roast Pheasant
Penguin a la *Scotia*
Potatoes Brussel Sprouts
Plum Duff a la Drift
Preserved Fruit
Coffee & Cigars

A toast to absent friends was drunk in champagne, and the remainder of the evening was spent in lively discussion on that favourite of all Scots' topics - Home Rule!

The summer season was very successful, and towards the end of January, preparations were well under way for the return of *Scotia*. As each day passed, however, and there was no sign of the vessel, Mossman began to fear for her safety. By the middle of February he decided they would have to prepare for a further winter on the island. The roof and walls of the hut were put in order; old clothing repaired and patched up, and experiments were tried to see if animal skins could be used as footwear. A rationing scheme, to take affect from 15th February, was organised, but on the 14th, during the noon meteorological observation, *Scotia* was sighted, and by that evening had anchored in Jessie Bay. The shore party then heard of the trying times their companions had experienced on their northern cruise.

Return Voyage to the Falklands and Buenos Aires

After leaving Laurie Island in late November 1903, *Scotia* reached the Falkland Islands on 2nd December. Again the crew experienced the kind hospitality for which the islanders are justly famous. New faces were seen, newspapers brought them up to date with world affairs, and there was the welcome accumulation of over a year's mail.

News of other Antarctic expeditions was eagerly sought. The *Discovery* with Scott was still ice-bound in the Ross Sea, the *Terra Nova* and *Morning* sailing to her relief. The Germans had returned safely from a not too successful expedition. Of the Swedes, there had been no news since they sailed from Tierra del Fuego in January 1902. Conscious of his earlier promise to Nordenskjold, Bruce immediately took on coal and prepared to sail for the Antarctic Peninsula to complete a detailed search for survivors. This, however, proved unnecessary. Just before they were due to leave the Falklands, word was received that the Chilean vessel *Uruguay* had successfully rescued the whole expedition. The Swedish vessel had been crushed in the ice, and the party forced to survive two winters in the Antarctic.

While the *Scotia* crew was being feted in on the Falklands, Bruce took the mail steamer to Buenos Aires, where he made the necessary arrangements for the vessel's refit when she arrived in the Argentinean capital shortly after Christmas.

Bruce telegraphed the expedition's Secretary in Scotland to report the safety of the expedition. Despite their achievements, the ever-reticent leader's message was short and to the point:

> Buenos Aires. Scotia, Stanley, December 2. Refitting here. Hydrographic surveyed 4000 miles unexplored ocean; 70025'S, 170 to 450 W: 2700 fathoms trawled there; wintered Orkneys; detailed survey. Mossman and five men continue first-class meteorological biological, magnetic station. Ramsay died August 6. All others robust. Scotia splendid. Bruce.

Serious Financial Problems

Now back in civilisation, the leader was again concerned about the expedition's dire financial state. Funds were low and the future looked black. As he wrote at the time:

> "My trials however, had only begun, and we were not to sail from Buenos Aires for another month. The funds of the expedition were exhausted and I was only capable to keep things going by a few subscriptions sent by friends.....No one except Ferrier and Whitson at home, and myself.....knew the anxious time I was having and even these two could not realise what a wretched time it was.....One thing was certain that at all costs I must get back to the South Orkney Islands, even if I dismissed half the crew and mortgaged this ship. Mossman and the five other Scotia men were there, and must be relieved or provided with more stores if they were to winter..." (Brown, 1923).

An appeal for further capital brought a rapid response from Bruce's friends in Scotland; again the Coats family were in the forefront with their generosity, donating a further £6,500.

Meteorological Programme

Realising the value of the weather programme on Laurie Island, Bruce discussed this with the Argentinean meteorological service and successfully arranged for the Argentinean Government to accept the responsibility for the observatory for a further year. In return for transporting a party of their meteorologists to the South Orkney Islands, the Argentineans promised to send a relief expedition the following season to embark the party. (This initial small Argentinean expedition, which Bruce hoped would be under the command of Mossman, was replaced by further national expeditions, and today, over 90 years later, the Argentineans still maintain the observatory on Laurie island).

Ten days after leaving Buenos Aires, *Scotia* again reached the Falklands, on 31st January 1904. A week later, again laden with stores and building materials, she sailed for Laurie Island, where both parts of the expedition were reunited. Mossman readily agreed to Bruce's suggestion that he remain for a second winter in charge of the meteorological party. The vessel lay at anchor for a further week, during which time the hut was completely repaired, stores landed, and the collections made during the summer taken on board.

Finally, on 22nd February, *Scotia* sailed from the island for the last time, leaving behind Mossman, one other member of the Scottish expedition, and three Argentineans. Heading into the Weddell Sea they found conditions were much better than in the previous year. In relatively ice-free waters the vessel made good progress until after it crossed the Antarctic Circle.

The Weddell Sea and near Disaster

The scientific routine was restarted, and continued throughout the rest of the cruise in the Weddell Sea. At 10.00 a.m. on 2nd March, in latitude 72° 24' S, longitude 17° 30' W, land was sighted at 11 miles distance. Bruce described the new land as follows (Bruce, 1911):

> "The sea front of the land was varied, there were great stretches of ice cliff, possibly 100 to 150 feet high, forming here marked bluffs or headlands and there were deep bays. Then at places the ice-sheet rounded off into a gentle slope to the sea, where I believe landings could be affected: at other places it nearly came down in a spit, on each side of which was an ice face..."

No rocks broke the surface of the ice scape. Sea ice conditions and bad weather prevented a closer approach until four days later, on 6th March, when the vessel was able to bear down on the land and sail along about 150 miles of its length. Correctly concluding that the newly-discovered land was part of the Antarctic Continent, Bruce named it Coats Land in recognition of the family who had been his main patron.

Reaching latitude 74° 01' S, disaster struck, with the *Scotia* becoming caught in the ice and stuck fast (Plate 4). Great slabs of ice were heaved over each other and pushed against the ship's sides. The strain on *Scotia* was immense as she creaked and shuddered under successive waves of pressure. With winter fast approaching, the future looked bleak. Even if they survived a winter in the pack ice, with *Scotia* damaged there would be little hope of rescue, since no-one outside the ship knew their whereabouts. These dangers did not halt the scientific work, and as the ship

Plate 4

Scotia

Beset in pack ice off Coats Land, 74° 01'S.
March 1904.
(No. 7 of a series of postcards published after the expedition).

drifted in the pack, daily samples were collected through holes cut in the ice, and regular soundings made of the sea-bed. The crew still exercised on the ice, and on one occasion enjoyed a game of football on a nearby flat ice-floe.

For several days no free water could be seen from the mast head, and temperatures regularly fell below 0° F, with the ice freezing hard. Captain Robertson, however, remained optimistic and maintained that if the wind moved to the south, this would ease the ice sufficiently to allow the ship to escape. On the morning of 12th March, the wind finally moved to the south-west and shortly after 10 a.m. a lead opened. This quickly widened and hopes of release grew. Further leads appeared, but the vessel remained trapped in her ice-floe, which measured about 200 yards wide. For most of the day the crew tried to break out, but by eight in the evening all their efforts, including blasting and digging, had failed. The captain decided to call a halt for the night. Shortly after all the hands had gone below, a crack was heard and the ship gave a lurch. Robertson hurried on deck and found *Scotia* free from the floe, but unfortunately still in dense pack-ice and she could make no headway against the drift of the ice.

On the following day, as the ice continued to loosen in the southerly winds, open water began to appear between the floes. Hopes began to rise that there was a real possibility of escape, the problem now being how to get clear of the pack. Here Robertson came into his own. Using experience gained over many seasons in icy waters, the master successfully picked a way between floes, sailing from lead to lead. Once clear of immediate danger, Bruce was determined to remain a little longer in the Weddell Sea, to continue with scientific research. Marine life was rich and varied, reflected in the haul taken on 18th March in latitude 71° S. This included:

> "two large stalked sponges, several other sponges, three or four large purple holothurians, brilliant red crustacea; two species of isopod; five or six chaetopods; three or four gastropods; a large number of grey and lavender sea-anemones; three species of brittle star; five of fish, including one of a beautiful blue and delicate grey-lavender colour, and one of which only the head was secured, remarkable for its crocodilian appearance with long toothed jaw; ctenophores, bryzoa and alcyonarians - altogether sixty species" (Bruce, 1911).

The lengthening dark nights and continual threat of collision with icebergs made navigation dangerous and difficult. Bad weather was now prevailing, and with severe north-westerly gales blowing for several days on end, *Scotia* rolled and pitched her way out of the Weddell Sea. Taking in sail was now a dangerous

exercise. On 2nd April, the worst seas of the whole cruise were experienced. Walls of green water regularly thundered onto the decks - a gig was so battered that it had to be cut adrift, a wave washed away the laboratory skylights, and several berths along with the galley were under water for much of the day. During these tiring days, work other than steering the ship and meteorological observations could only be attempted during periods of relative calm. It was in one such period that the bathymetric soundings discovered a further part of the submarine Scotia Ridge.

A four-day gale quickly pushed the *Scotia* north, but slowly the weather improved, and on 20th April a land sighting was made of Gough Island, a small volcanic island in the middle of the Southern Ocean about 500 miles south-west of South Africa. Two days later a landing was made, and, although only a few hours were spent ashore, a valuable collection was made - sixty species of plants were found and eleven species of birds new to the island were recorded. Signs of human habitation reminded the expedition of the island's use as a base for sealing.

After leaving Gough Island, a course was set for Cape Town, which was reached on 5th May 1904. When there, Bruce gave Reuters a short but far from sensational account of the expedition. It read:

> Have made bathymetric survey of 4400 miles of ocean, soundings and trawling in 2660 fathoms; left Mossman and four others in Scotia Bay, South Orkneys; discovered great ice barrier 74 degree south, 17 to 28 degrees west; experienced bad weather; arrived good condition; all well; Bruce.

Homeward Bound

After two weeks in the South African capital, *Scotia* sailed for Scotland. Fair weather prevailed and the vessel sailed quickly north through the Atlantic. In mid-July Ireland was reached, and on 22nd July 1904 *Scotia* sailed up the Clyde and anchored off Millport. Their arrival was triumphant, and on landing a letter of congratulations was received from the King. Bruce was presented with the gold medal of the Scottish Geographical Society, while Captain Robertson received the Society's silver medal. When the immediate festivities at Millport were finished, *Scotia* continued her voyage to Gourock, where the expedition ended and the crew were paid off. The vessel was closed down after a voyage of 33,000 miles.

No sooner were the results of the expedition known than scientists and fellow explorers sent their congratulations to Bruce and his colleagues. Frijof Nansen, the eminent Arctic explorer, and never a man to give undeserved praise, congratulated

Bruce for having been able to solve the chief problems of the Weddell Sea. Sir Joseph Hooker, the botanist on the James Clark Ross expedition of 1839, greatly praised the expedition, listing the discovery of Coats Land as its most important achievement.

Achievements

But what did the Scottish National Antarctic Expedition actually achieve? It brought back to Scotland the largest collections of scientific samples and the most detailed observations ever made in the south polar regions. The main successes were in the fields of oceanography and meteorology. Of the many geographical discoveries, the most important were the Scotia Ridge and Coats Land. In addition, soundings of over 4,000 miles of unchartered seas were completed, and several hundred samples collected containing many species of animals and plants new to science. Like the observations at sea, the collections and surveys of the islands visited, in particular Laurie and Gough, added greatly to our knowledge of these areas.

As well as the expedition's own meteorological data, Bruce was directly responsible for the establishment of the longest-running continually manned meteorological station in Antarctica.

The majority of the expedition's scientific results were edited by Bruce, and were published in seven large volumes (Bruce, 1907-20). The scientific staff also wrote about their findings in many of the learned scientific journals of the period. It was only by Bruce's determination that funds were made available for these publications, but even today there is still a large amount of material in the National Museums of Scotland awaiting examination. Unlike other expeditions of the period, there were few publications available to whet the appetite of the public about the voyage, apart from the official narrative. I know of only one, a delightful booklet of sixty photographs published in 1907 (Anon., 1907).

Bruce had proved that, given the minimum of funds, a small nation like Scotland could mount, organise and execute its own expedition. It was unfortunate that the leader's own personality, his lack of showmanship, and his inherent belief that science alone was sufficient to sell the venture to the media, were the main reasons why the *Scotia* expedition never received the recognition with the general public that it has had in the scientific world. This was all the more unfortunate because Bruce's belief was that through the expedition the spirit of

Scotland could achieve its own national recognition. A photograph of Bruce appears in the paper on 'Bruce and the Arctic', elsewhere in this volume (Speak, 1999).

This spirit might best be summed up by quoting from the narrative of the voyage:

> "....it was the truly Scottish nature of this expedition. Germany, Sweden, and England, and later France, each had its own expedition, several of them aided by Government support. It remained for Scotland to show that as a nation her old spirit was still alive, and that she could stand beside the other nations and worthily take her place in this campaign of peace. It was in this spirit that the Scottish National Antarctic Expedition was planned, organised and carried through by its indefatigable leader, Mr. William S. Bruce" (From the preface to *The Voyage of the "Scotia"*).

As the centenary of this expedition approaches, and with the rebirth of the Scottish parliament, surely it is not too much to ask that this Scottish hero and his achievements should now be fully recognised.

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NATURALISTS AT WORK: THE PHOTOGRAPHIC ARCHIVE OF THE *SCOTIA* VOYAGE

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Introduction

Since it was founded in 1884 the Royal Scottish Geographical Society has been gifted nearly 30,000 photographs in the form of prints, glass plates and 35mm slides. Primarily a record of travel, exploration, and scientific endeavour during the twentieth century, the most prized of these are the photographs gifted to the Society in 1920 by Dr. William Speirs Bruce (1867-1921) leader of the Scottish National Antarctic Expedition (1902-04) and founder of the Scottish Oceanographical Laboratory (1).

William S. Bruce Collection

Of more than 1,300 photographs taken on various expeditions to the Arctic and Antarctic, some 200 or more of the images in the William S. Bruce Collection record the voyage of Bruce's ship, the *Scotia*, and the work of the scientists who participated in the Scottish National Antarctic Expedition (see Plates 1 to 8). In addition to these photographs, the Royal Scottish Geographical Society also holds associated maps, manuscripts, printed volumes, and three-dimensional artefacts including one of the cameras taken to the South Atlantic by William Bruce. All of these items complement other substantial collections of material relating to the voyage of the *Scotia* held by the University of Glasgow (2), the University of Edinburgh (3), the Royal Museum of Scotland (4), the Scott Polar Research Institute, and the Royal Geographical Society.

Early Extensive Use of Photography

Although the Scottish National Antarctic Expedition was certainly not the first of its kind to make use of the camera, it was one of the first to make extensive use of photography to cover every aspect of the expedition, from the refitting of the vessel and life on board ship, to the recording of scenic views, wildlife and naturalists at work. Many of these photographs were subsequently used to illustrate scientific reports, journal papers, and general expedition accounts. One of these accounts was compiled by three of the expedition's scientific staff, R.N.

Plate 1

The S.Y. *Scotia*
icebound in Scotia Bay, Laurie Island, South Orkneys.

Plate 2

The geologist and bacteriologist, Dr. J.H. Harvey Pirie, catching *Velellas* in mid-Atlantic.

Rudmose Brown, R.C. Mossman and J.H. Harvey Pirie. Published in 1906 under the title *The Voyage of the "Scotia"*, this volume included 105 photographs by way of illustration (Three of the Staff, 1906).

The *Report on the Scientific Results of the Voyage of S.Y. "Scotia"* was published for Bruce's Scottish Oceanographical Laboratory in seven volumes between 1907 and 1920 by Oliver and Boyd of Edinburgh and James Maclehose of Glasgow (Bruce, 1907-20). It is extensively illustrated, not only with hand-drawn scientific sketches but also with photographs of birds, plants and animals. Most of the photographs were taken by William Bruce himself, but some were taken by the geologist and bacteriologist Dr. J.H. Harvie Pirie and the botanist Dr. R.N. Rudmose Brown. Additional close-up images of invertebrates and other microscopic organisms were supplied for these volumes by Dr. Clement Vaney, J. Green, A.H. Maxwell and Dr. J.H. Ashworth, many of these photographs being taken once samples had been brought back to Britain. They supplement the detailed sketches which were made by Dr. Bruce and his research staff, and were reproduced for the *Report* by the Edinburgh lithographers McFarlane & Erskine.

The sheer volume of photographs of wildlife and scientists at work taken during the two years of the Scottish National Antarctic Expedition is testimony to the new-found importance of the camera as an instrument of scientific record. In particular, the camera was used to record breeding populations of seals and the larger species of birds, including penguin, skua, petrel and shag. The occurrence of the Black-bellied Storm Petrel *Fregetta melanogaster*, and finding the eggs of the Cape Pigeon *Daption vapensis* and the young of the Snowy Petrel *Pagodroma nivea*, were amongst the important ornithological discoveries of the Scottish National Antarctic Expedition (Bruce, 1911). An account of activities on Laurie Island at the coming of spring noted that "we had still plenty to do in collecting and photographing bird-life" (Three of the Staff, 1906: 142). This task proved easier than expected, since "To get photographs we at first began stalking them yards away, but there was no need for such caution; they sat quite unconcernedly till we were within a few feet" (Three of the Staff, 1906: 171).

William Bruce had considerable experience with the camera in polar regions. His appointment as naturalist on the Jackson-Harmsworth Expedition to Franz Josef Land in 1896 had launched him into the world of oceanography. Spending more than a year in the Arctic, in company with Armitage, Koettlitz and Wilton, he had initially used the camera to record images of both rocks and plants. Two years later he joined Andrew Coats on board his yacht *Blencathra* on an expedition to Novaya Zemlaya, a voyage which brought him into close contact with the thread-manufacturing magnates of Paisley who were to fund the Scottish National

Plate 3

Photographing the full wing-span
of a Giant Petrel *Ossifruga gigantea*.

Plate 4

Naturalists at work with camera in hand
amidst a penguin rookery in the South Orkneys.

Plate 5

The Weddell Seal *Leptonychotes weddelli*
on pack ice off Coats Land 74° S,
photographed in March 1904.

Plate 6

Piper Gilbert Kerr serenading a penguin.

This photograph is a classic image from the *Scotia* voyage.

It was reproduced as a postcard, one of the first to be sent from the South Atlantic.

Antarctic Expedition. This expedition gave him a further opportunity to develop his photographic skills.

That Arctic voyage in turn brought Bruce into contact with Honore Charles Grimaldi, who was to become Prince Albert the First of Monaco a year later. After their first encounter at Tromsø, Bruce was invited to join the Prince's new yacht *Princesse Alice II* for an autumn voyage to Spitzbergen. The chief scientist on board the Prince's yacht was Dr. Jules Richard, who was to become President of the French Zoological Society. A pioneer of scientific photography, Richard had developed the Verascope camera which was designed to take stereoscopic images. Bruce, who had made extensive use of cameras during each of his previous Arctic expeditions, was sufficiently impressed by the Verascope to add it to the collection of cameras taken on the *Scotia* voyage three years later. This camera has recently been gifted by the descendants of Dr. William Bruce to the Royal Scottish Geographical Society on permanent loan. The stereoscopic images of wildlife captured during the Scottish National Antarctic Expedition, and now held by the University of Glasgow, were taken using this camera.

In addition to stills photography, Bruce endeavoured to make use of cine film during the Scottish National Antarctic Expedition. This medium proved less successful in cold climates. It jammed "as usual", as Bruce recorded with evident irritation on 29th February 1904 after shooting some seven yards of film (Speak, 1992). Gifted to the Royal Scottish Geographical Society by Dr. Bruce, this film is currently held by the Scottish Film Archive.

Early Photographic Guide for Travellers

One of the earliest descriptions of photography as an aid to scientific research is to be found in the seventh edition of the *Hints to Travellers* guide, compiled in 1893 for the Royal Geographical Society by W.F. Donkin, lecturer in chemistry at St. George's Hospital, London. Later updated by J. Thomson, the Royal Geographical Society's instructor in photography, the guide notes that "The photographic camera should form an essential part of the traveller's outfit, as it affords the only trustworthy means of obtaining pictorial records of his journey, and it is also helpful in making the survey of a new region, delineating its contours, its geological and botanical features, and ethnographic types of race".

Photography now a Valued Tool

By the time the *Scotia*, set sail in November 1902, the role of the camera had become more sophisticated compared with earlier oceanographic expeditions.

Plate 7

Captain Robertson and Mr. Fitchie fixing *Scotia*'s position, the first of a series of photographs reproduced as postcards in 1904.

Plate 8

R.N. Rudmose Brown, David Wilton and J.H. Harvey Pirie
in the *Scotia* laboratory, which was located in a deck-house admidships.

Next to a second laboratory, located beneath this, was a photographic dark room "fitted up in the most complete and modern fashion".

The scientists are seen wearing the Fair Isle jerseys gifted to the expedition by James Coats.

During the *Challenger* Expedition thirty years earlier, the camera had been used only sparingly, to record landscapes. The principal and more detailed scientific observations were recorded by the naturalist H.N. Moseley and the *Challenger*'s official artist J.J. Wild (Linklater, 1972). By the turn of the century photography had become a tested means of recording scientific observation, although artists continued to be important members of major expeditions. On several occasions William Bruce had travelled to Arctic and Antarctic regions with his friend the artist W.G. Burn Murdoch, who was himself a keen photographer experimenting with stereo and panoramic photography. During and after the *Scotia* voyage, Bruce made countless scientific sketches and included in his team the artist William Cuthbertson, who had studied in the art schools of Edinburgh and Paris. The camera lens, however, remained Bruce's most valued tool for recording scientific observations.

Conclusion

While the photographs taken by the Scottish National Antarctic Expedition have not perhaps achieved the prominence of those taken, for example, by Frank Hurley on the later *Endurance* expedition, the photography of William Bruce deserves a special place in the history of geographic exploration. His record of the *Scotia* voyage, though by no means the first expedition to use a camera, is certainly one of the earliest to comprehensively illustrate an entire maritime expedition, including the scientific work carried out by its naturalists. Not only that, it is a unique record of an oceanographical expedition from the 'Heroic Age', described fifty years later by Rudmose Brown as "one of the last of the old-time efforts with a wooden ship, with auxiliary steam, no radio, no mechanical transport, and no sonic sounding" (Brown, 1952).

Notes

1. A postcard sent by Dr. William Bruce from Chalmer's Hospital on 16th April 1920 offered the R.S.G.S. "the gift of all my lantern slides if I may use them occasionally". The offer was accepted by the Society's Secretary, George Chisholm, in a reply the following day. A more formal letter, dated 24th December 1920, was subsequently sent by Dr. Bruce to the Society, noting that he had pleasure in gifting to the R.S.G.S. a number of items, including "lantern slides with cases and boxes".
2. Over 250 glass negatives of stereoscopic images taken by Dr. Bruce's verascope camera are held in the archives of the University of Glasgow [DC404 Scottish National Antarctic Expedition].
3. Dr. Bruce's library of polar books was presented to the University of Edinburgh, in addition to seven volumes of photographs and several expedition log books.

4. Manuscripts relating to Dr. William Bruce held by the Royal Museum of Scotland are listed in *Manuscripts in the Royal Scottish Museum Edinburgh, part 2, William S. Bruce Papers and Diary of A. Forbes Mackay,* Information Series, Natural History 8 (March 1982), edited by Joy Pitman. In addition, the Royal Museum holds many of Bruce's zoological and geological specimens as well as his scientific equipment. Specimens were also presented to Scottish museums in Dundee, Glasgow, Paisley, and Perth when the contents of William Bruce's Scottish Oceanographical Laboratory were dispersed in 1920-21.

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BRUCE AND THE ARCTIC

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Introduction

Although William Speirs Bruce is best known today for his leadership of the Scottish National Antarctic Expedition (in *Scotia,* 1902-1904) he did in fact spend more of his time, as a polar naturalist, in the Arctic than in the Antarctic. Between his first expedition to Franz Josef Land in 1897 and his death in 1921 he visited the Arctic, mainly Spitsbergen (now renamed Svalbard), on ten occasions. Throughout his professional life he was devoted to polar science and natural history: he had no other full-time occupation, and his life was spent in the advocacy of polar exploration and in the collecting and classifying of polar information of all kinds. In 1909 he opened, and then superintended, the Scottish Oceanographical Laboratory in Nicolson Street, Edinburgh. There he exhibited zoological and geological specimens, polar charts, photographs, exploration equipment, and meteorological data which he had brought back on various expeditions to both polar regions. It was at this laboratory that the Scotia Reports were prepared for publication, and it was the home of the Scottish Spitsbergen Syndicate, founded by Bruce in 1909. The laboratory closed in 1919 because of lack of funds, and the collections were distributed in 1920 to various museums, scientific institutes, and universities around Scotland.

The Making of a Naturalist

Bruce (Plate 1) came from Scottish descent on his patrilineal line (his mother was Welsh), but there is little evidence that, in his early days, he had much contact with Scotland. He was born on 1st August 1867 at 43 Kensington Gardens Square, where his father conducted a general medical practice in a fashionable district of London. He was the fourth child in a family of eight children, all of whom were educated at first privately at home. After William Bruce's death in 1921 his father (Samuel Noble Bruce) wrote to his son's close friend and biographer, R.N. Rudmose Brown:

> "My father and sister were almost the sole teachers, as they were the chief companions of the children, and it was their daily custom to go out with them into Kensington Gardens, which were near, and sometimes into the

> Natural History Museum, which was not far off. To these influences is due, as I think, his interest in life and nature" (Speak, 1992a).

At the age of eleven Bruce was sent to a private boarding school in Norfolk, and subsequently for two terms to University College School, London. His father intended his son to read medicine at University College, but in the summer of 1884, the seventeen year old William joined a vacation course in biology newly opened by Patrick (later Sir Patrick) Geddes at Granton on the Firth of Forth. The students learned laboratory techniques aboard an old canal barge, the *Elizabeth*, and then accompanied Geddes on long walks as he demonstrated the natural history of the sea shore. Geddes was a polymath-biologist, geographer, sociologist, architect and town planner, as well as an early environmentalist and ecologist. He was also a fine teacher, and believed in the holistic approach to environmentalism and the natural world.

This was to be a turning point in Bruce's life (Speak, 1992a): not only did he find a renewed interest in natural history and a novel approach to environmental studies, but he was befriended by Geddes for the rest of his life, and was introduced by him to the great Scottish scientists of the age. Bruce threw over any idea of attending London University, applied to the University of Edinburgh to follow courses in medicine, settled in Scotland and based himself there for the rest of his life.

There could have been nowhere better for an aspiring naturalist and polar oceanographer at that time than Scotland and the city and University of Edinburgh. In the north-east coast ports there were icemasters and whalers eager to reconnoitre new fishing grounds, and shipowners anxious to find replacement waters for the declining catches in Arctic seas. The famous *Challenger* Expedition of 1872-1896, the first great voyage of oceanographic discovery, was mainly a Scottish enterprise and Bruce was soon recruited to work with James Murray and John Young Buchanan (both were subsequently knighted), helping with the cataloguing of specimens and the preparation of the Reports in the Challenger Office.

At the University he was taught by eminent scientists, amongst whom were Professor Cossar Ewart and Sir William Turner (anatomy and physiology), Professor J. Arthur Thompson (natural history) and Professor P.G. Tait (natural philosophy). He had taken up residence in Riddle's Court in the Lawnmarket in a Hall established by Patrick Geddes. An account of Bruce's happy and carefree life can be read in the chapter 'Edinburgh University Days' in Rudmose Brown's biography of Bruce, *A Naturalist at the Poles* (Brown, 1923).

Plate 1
William Speirs Bruce

In September 1892 the Dundee whaling company owner, Robert Kinnes, was preparing four vessels to search in the Antarctic for new whaling grounds, and particularly for the Southern Right Whale, as had been reported by James Clark Ross aboard H.M.S. *Erebus* some thirty years earlier. Bruce abandoned his studies and signed on the whaler *Balaena* as surgeon and naturalist; his friend Burn-Murdoch shared his cabin as artist to the expedition. They sailed from Dundee bound for the Weddell Sea on 7th September. Although the expedition was a failure as a whaling reconnaissance, for no Right Whales were seen, nevertheless Bruce carried out some scientific work, with meteorological and oceanographic instruments supplied to him by scientists both in Scotland and in London. In order to cover their costs, the crews of the four ships slaughtered and filled their holds with blubber and seal oil from islands of the Antarctic Peninsula. Bruce found the work distasteful, but it provided him with invaluable experience of the biology of seals. He was also able to collect other specimens: penguin skins, skulls and eggs, and a small dolphin; there was sufficient to stir the interest of the Royal Scottish Geographical Society and kindred Scottish institutions.

Bruce was fired with enthusiasm for polar natural history (Bruce, 1911), and wrote in a letter, dated 4th June 1893, to Dr. H.R. Mill, the Librarian of the Royal Geographical Society in London: "I am burning to be off again anywhere, but particularly to the far South where I believe there is a vast sphere for research. The taste has made me ravenous". He was destined to visit the Arctic, however, before he could again go south. He first needed to earn a living, and was fortunate to be offered, by the pioneer Scottish meteorologist Sir Alexander Buchan, in June 1894, the post of superintendent of the summit weather station on Ben Nevis. Bruce believed that this was as near as he could come at that moment to reproducing the conditions of a polar environment! Fortune again smiled on him in June 1896, when he received a telegram at the Ben Nevis Observatory from Mill offering him the position of naturalist to the Jackson-Harmsworth expedition in Franz Josef Land.

Franz Josef Land

The Jackson-Harmsworth Expedition was sponsored by the publisher Alfred Harmsworth (later Lord Northcliffe) and had established a base named Elmwood, at Cape Flora, at the western extremity of Northbrook Island, the southernmost island of the Franz Josef archipelago in latitude 80 degrees North. The leader was Frederick George Jackson, a well-known big game hunter who professed to be interested in scientific enquiry, but was essentially there to shoot Polar Bears and birds. The game-book shows that over 80 bears were killed and many hundreds of birds, mainly by Jackson himself, but there were other scientists with the

expedition: Dr. Reginald Koettlitz, surgeon and geologist; Harry Fisher, botanist and zoologist; and Albert Armitage in charge of astronomical, meteorological, and magnetic observations. Koettlittz and Armitage were to join the *Discovery* Expedition under Captain R.F. Scott to the Antarctic in 1901.

Bruce therefore had good company for his first work as naturalist in the Arctic, and acted as zoologist to the expedition. The others had already spent over a year at Elmwood, and Bruce was aboard *Windward* bringing fresh supplies from London. He carried out oceanographic work on the outward voyage, and from Archangel onwards was accompanied as assistant zoologist by a young man, David Wilton, who was destined to go with Bruce in 1902 to the Antarctic aboard *Scotia* (Three of the Staff, 1906; Speak, 1992c). This was a marvellous experience for Bruce, then thirty years old. He had already been to both the north and south polar regions (Bruce, 1911). He brought back to Scottish museums a representative collection of vertebrate and non-vertebrate organisms and a substantial collection of bird skins, eggs, rocks and skeletal remains. He had moreover practised some topographical surveying in the company of Jackson and Koettlitz and was becoming expert in polar zoology, oceanography, and meteorology. Throughout the winter he trawled daily through holes in the ice, and on one occasion reached a depth of 234 fathoms.

By wonderful good fortune the new arrivals at Elmwood discovered that Fridtjof Nansen, the Norwegian polar explorer, and his companion Hjalmar Johansen, had recently arrived from their epic sledge journey from *Fram* left fast and drifting in the Arctic ice. They had been missing for three years, and the world believed that they had died and the ship had foundered. For Bruce it was the beginning of a friendship with Nansen which lasted for the rest of his life.

Novaya Zemlya

On returning to Scotland, Bruce resumed his duties on Ben Nevis, this time assisted by David Wilton, and by Robert Cockburn Mossman, a professional meteorologist who was also recruited later by Bruce for the Antarctic on *Scotia*. Bruce also assisted Professor J.A. Thomson in his lectures and demonstrations in Edinburgh, but he was soon called again to the Arctic, this time by Andrew Coats of the well-known family of thread manufacturers in Paisley. The voyage was in the yacht *Blencathra,* and it was to be a pleasure and sporting cruise to Novaya Zemlya and the seas off Spitsbergen. Bruce was to serve as naturalist. Bruce was in his element, conducting deep-sea soundings, bird observations, and meteorology. Landing on Novya Zemlya was made but briefly, also on Kolguev Island, but ice conditions were too severe for an extended stay. It was not possible

to land on Bear Island, the southernmost island of the Spitsbergen archipelago, but Bruce caught tantalising glimpses of Bear Island, Hope Island and Edge Island before returning to Tromsø in northern Norway. *Blencathra* was well equipped for scientific work and Bruce made the most of the facilities: He observed at 249 scientific stations, completed 34 hauls with the dredge and trawl, made 60 collections of plankton, 80 soundings of the ocean depths, and 30 salinity measurements.

On arrival at Tromsø in July 1898 he found, berthed alongside, the finest oceanographical research vessel of the day, *Princesse Alice,* owned by the Prince of Monaco. The Prince invited Bruce to join the ship, and within four days he was off back to the Arctic and to Spitsbergen. It was the beginning of Bruce's golden years, for on board were the most famous oceanographers of the time: Dr. Jules Richard of the Monaco Oceanographical Institute, Professor Karl Brandt of Kiel University, and Sir John Young Buchanan of Edinburgh. The scientists cruised the western shores of Spitsbergen, visiting Storfjord, Icefjord, and all the principal bays. Plants were collected on land, marine specimens acquired by dredge and trawl, and Bruce had the responsibility for the daily observations of salinity, sea temperatures, and plankton collections. On return, Bruce was invited to spend the winter of 1898-1899 with the Prince in Monaco, perfecting his work as a marine naturalist.

The Spitsbergen (Svalbard) Years

From 1899 until his death in 1921 Bruce visited and revisited the Spitsbergen archipelago (Figures 1 and 2) on eight separate occasions. In the summer of 1899 *Princesse Alice,* with Bruce on board as naturalist, returned to Spitsbergen and carried out principally hydrographic work along the west coast as far north as Red Bay. Bruce worked mainly with Dr. Richard. By then there was probably no other British naturalist so well qualified in polar science as Bruce.

On returning to Edinburgh he began preparations for the Scottish National Antarctic Expedition (1902-1904) which carried out invaluable investigations of the Southern Ocean, based primarily on Laurie Island, South Orkneys (see account elsewhere in this volume), and it was 1906 before he returned to Spitsbergen aboard *Princesse Alice* to begin a topographical and geological survey of Prince Charles Foreland, which was completed the following year when he sailed aboard *Phoenix*. He found some evidence of iron ore deposits on Prince Charles Foreland, and was aware of extensive deposits of coal and gypsum on the mainland. The attractiveness of commercial exploitation of minerals in an island group which was effectively *terra nullius*, so that the staking of claims was free,

led to Bruce establishing in Edinburgh a mineral exploration company in 1909, the Scottish Spitsbergen Syndicate.

His main ally in the field was his friend and colleague from *Scotia,* Dr. Robert Neal Rudmose Brown. Bruce, with Brown and others, visited Spitsbergen on behalf of the Syndicate in 1909, 1910, 1912 and 1914, and after the war in 1919 and 1920, but commercial success eluded them, although Bruce was able to bring home extensive reports on the natural history of Spitsbergen. He crossed the main island from east to west over difficult icy terrain and explored Edge Island, making discoveries of numerous potential mineral sites and producing topographic maps.

The enterprise was organised, by Bruce, from his Oceanographical Laboratory in the grounds of Surgeon's Hall, Nicolson Street, Edinburgh which had been opened by His Serene Highness the Prince of Monaco in 1906. It was essentially a museum of polar natural history.

Awards

Although Bruce was bitterly disappointed that neither he nor any of the members of the *Scotia* Antarctic Expedition was offered the Polar Medal, he did receive other significant honours during his lifetime (Speak, 1992a):

1904 Gold Medal of the Royal Scottish Geographical Society.
1906 Honorary Doctorate of Letters, University of Aberdeen.
1910 Patron's Medal of the Royal Geographical Society of London.
1913 Neill Prize and Gold Medal of the Royal Society of Edinburgh.
1920 Livingstone Gold Medal, American Geographical Society.

Conclusion

The achievements of Bruce as a polar scientist were prodigious, and his contribution to marine natural history extensive. He was one of a very few scientists at that time to operate in both the north and south polar regions, he led a highly successful expedition to the Antarctic (Speak, 1992b), and he brought back to Scotland countless marine and bird specimens, volumes of reports concerning polar meteorology, geology, physical oceanography, and maps of hitherto uncharted coastlines. He was generous with his materials, providing specimens for others to work on and giving opportunities for Scottish scientists to sample the polar environments of Arctic and Antarctic lands and seas.

Figure 1

Location of Spitsbergen

Figure 2

The Spitsbergen Archipelago

SVALBARD

10°
15°
20°
25°
80
79
78
77
NORDAUSTLANDET
(North East Land)
Ny-Ålesund
VEST
(West)
SPITSBERGEN
Pyramiden
Land
Billefd
Bunsow
Land
K Thordsen
Sassenfd
Tempelfd
BARENTSOYA
Barents Is
Mohnbukta
Isfjorden
Longyearbyen
Barentsburg
Grønfd
Agardhbukta
EDGEOYA
Edge Is
Bellsund
Recherchefj
STORFJORDEN
Scale
1 : 2,000,000

His Oceanographical Laboratory closed for lack of funding in 1919, and his collection was dispersed amongst Scottish Universities and Museums. Had there been sufficient interest in his Oceanographical Laboratory it might have developed, as Bruce fervently hoped, into a major Museum or Institute of Natural History.

Bruce became ill in 1919, chiefly due to both mental and physical exhaustion. He was treated in Edinburgh and was able to accompany the Scottish Spitsbergen Syndicate's first post-war visit to Spitsbergen in the summer of 1920. He died in Liberton Hospital, Edinburgh, on 28th October 1921, and, according to his wishes, his ashes were scattered in a high latitude over the waters of the Southern Ocean, just outside the harbour of Grytviken, South Georgia.

As the centennial anniversary of the Scottish National Antarctic Expedition approaches, it is to be hoped that full (if very belated) recognition will be given of William Speirs Bruce's contribution to Scotland's scientific achievements.

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WYVILLE THOMSON, *CHALLENGER*, and the EDINBURGH MUSEUM OF SCIENCE AND ART

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When the 'Pearl' class corvette H.M.S. *Challenger* sailed out of Portsmouth on 21st December 1872, to begin her epic round the world voyage, she carried on board not only Edinburgh University's Professor of Natural History but also the Edinburgh Museum of Science and Art's Keeper of Natural History. Three and a half years later the Professor was to return in triumph to his University post; the Keeper never returned.

Wyville Thomson, the Professor and the Keeper

Yet both the Professor and the Keeper were one and the same person, Wyville Thomson (Plate 2a), for on 7th November 1870 he had been appointed by Her Majesty Queen Victoria to the dual office of "Regius Professor of Natural History, and Keeper of the Museum or Repository of Natural Curiosities in the said University [Edinburgh] during all the days of his lifetime" (Bruce, 1870). Here it should be noted that professorial appointments in the University of Edinburgh were of two kinds. The majority were made by the Town Council, as patrons of the University, but a few were made by the Crown. These chairs in the gift of the monarch were termed 'Regius' appointments, and the chair of Natural History, established in 1767, was one such professorship.

The Natural History Collections

Although Thomson's Royal Commission of appointment referred to the natural history collections being in the University of Edinburgh, this seems to have been a drafting error. For in 1865 they had been moved into a newly constructed government-funded public museum (Plate 1), on a site adjacent to the University, administered by the Science and Art Department of the Committee of the Council on Education based in South Kensington (Calder, c.1984). The first phase of this building was open to the public in 1866. (The building, and later phases of construction, was later to become the Royal Scottish Museum, subsequently the

Plate 1

Half of a stereo photograph showing the natural history collections shortly after their transfer into the Edinburgh Museum of Science and Art. The presence of the Gorilla, acquired in 1868, and the absence of free-standing floor cases, erected in 1871, places this photograph as having been taken between these dates.

Royal Museum of Scotland and later simply the Royal Museum, the headquarters of the National Museums of Scotland).

Thomson presented his Royal Commission of appointment to the University Court on 3rd October 1870, and was admitted as a member of the Senate in mid-December. Almost exactly two years later he sailed on *Challenger*.

The administrative arrangements made to provide for the continuance of his University duties during his absence have been discussed by Ritchie (1940) and Rice (1989). Recently, the arrangements made within the Museum have also been investigated. This was part of a more general study of the relationship between the Museum and the University with regard to the natural history collections (Swinney, 1999).

When Thomson accepted his Edinburgh appointment he was placing himself into an already thwart situation. But it was a situation of which he was not unaware.

Commission of Enquiry

In 1868 Thomson had served as one of the commissioners enquiring into the proposal to incorporate the collections of the Royal Dublin Society into a new government-funded public museum in Dublin (Commissioners, 1869). At the time, he held a chair in the Royal College of Science, Dublin. The Commission looked to Edinburgh for a model, since Edinburgh University's natural history collections had been incorporated into a public museum some thirteen years earlier. Amongst other issues, the commissioners had probed the relationship between the Museum's Director, a post held since April 1866 by Thomas Croxen Archer (Plate 2b), and the Keeper of Natural History, at that time George Allman. Their questioning revealed some tensions, largely resulting from the way the publicly-funded museum had been founded.

Origins of the Public Museum

In the middle of last century Edinburgh University had become increasingly concerned by proposals, which were circulating in the wake of the success of the Great Exhibition, to develop a museum of economic geology and industry on the site adjacent to the University The Senate feared that, should they come to fruition, these proposals would prejudice the University's own ambitions to expand its natural history museum. The Senate lobbied the government to have the University Natural History Museum incorporated into the proposed new publicly-

Plate 2

The Principal Protagonists

(a) **Charles Wyville Thomson**

(Baptised Wyville Thomas Charles Thomson, but following his knighthood in 1876, he changed the order of his forenames)

Plate 2

The Principal Protagonists

(b) **Thomas Croxen Archer**

funded museum (Grant, 1884). The history of the natural history collections is summarised by Swinney and Shaw (1998), and Waterston (1997) provides a detailed account of the background to the establishment of the government-funded museum in Edinburgh. Thus, in 1854 the natural history museum had been handed over by the University into government control on the understanding that the Professor of Natural History should continue to serve as Keeper and have responsibility for the collections (Hooker, Busk and Donnelly, 1873). By Act of Parliament, in 1854 funds had been allocated for the appointment of staff and a site had been acquired adjacent to the University, on which to establish a museum, "similar to those of Economic Geology and of Industry in London and Dublin" (Wilson, 1858), the intention being to incorporate newly-formed industrial collections with the existing natural history collections. During its planning and development the new government-funded museum had been called the Industrial Museum of Scotland (a title which was inclusive of the natural history collections). The first Director of the new museum was George Wilson, who soon after appointment to the museum directorship, was appointed also to a newly-created chair of Technology in the University (Wilson, 1856). Whilst new purpose-built accommodation was being designed and built, the Natural History Museum and the Industrial Museum functioned largely independently, the two professors "having co-ordinate duties as Curators of the Museums under their respective charge" (Wilson, 1858).

Archer's Appointment

As planning of the new museum progressed, however, things began to change. George Wilson, a dynamic innovative director, who had built the Industrial Museum largely from scratch despite inadequate temporary accommodation, had died in the winter of 1859 and had been succeeded as head of the Industrial Museum, re-styled 'Superintendent of the Industrial Museum', by Thomas Archer (Anon., c.1883; Findlay, 1954; Calder, c.1984). Archer received no University appointment (his title 'Professor' was an emeritus one, granted from a previous post he had held in Liverpool).

In February 1861 Archer addressed the Edinburgh Chamber of Commerce, taking the opportunity to emphasise his role as Superintendent of the Industrial Museum *in toto* (i e. inclusive of natural history):

> "It is a part of the Government plan that the general superintendent of the Museum shall have the assistance of local men of science, and doubtless Dr. Allman ... will continue under that arrangement to watch over the interests of his important department" (Archer, 1861).

The Edinburgh Museum of Science and Art

In November 1864, in anticipation of the move of both the industrial and natural history collections into the new building, and anxious to have appropriate new stationery printed, Archer requested that the Department of Science and Art consider a name for the new museum - he favoured "Royal National Museum of Scotland" (manuscript letter, 9th November 1864, in Director's correspondence 1863-68; N.M.S. Library archive). He acknowledged the Department's reply on 6th December 1864, and on 13th December for the first time used the name Edinburgh Museum of Science and Art as a letterhead (Director's correspondence 1863-68; N.M.S. Library archive). Archer was given the title Director, and his salary increased, with effect from 1st April 1866 (Anon., c.1883) and the Edinburgh Museum of Science and Art was opened to the public in mid-May (although the name 'The Industrial Museum' persisted in the press and in popular usage for several decades).

Archer and Allman

The relative status of Archer's and Allman's posts was a matter explored at some length by the Irish commissioners, who saw the potential for difficulties developing due to conflicting allegiances, with the Keeper simultaneously responsible to the Government, both directly and via the Director, and to the University in his capacity as a Professor. The commissioners reported:

> "It is quite evident that Professor Archer and Professor Allman have managed to conduct each their own department in such a way as not to come into any collision; but possibly such a collision might occur with men of less tact and temper" (Commissioners, 1869).

Thomson and Archer

When, two years later, Thomson succeeded Allman, the collision was inevitable. The two men clashed almost immediately. Although Thomson's Royal Commission appointed him "subject to any Regulation which may be made as to the management of the new Scientific and Industrial Museum for Scotland" (Bruce, 1870), Thomson refused to recognise Archer's authority as Director. He did not consider Archer (who had trained as a surgeon) to be qualified as a scientist, and stubbornly refused to address him as 'Professor', referring to him in all correspondence as 'Mr. Archer'. Thomson refused to undertake any museum duties until his own status had been clarified to his satisfaction. Accusations, often in most intemperate language, began to fly and Thomson wrote to Henry Cole, Secretary to the Science and Art Department, declaring "...I must be absolutely

independent in the Natural History department. There I cannot work under Mr. Archer in any sense...to attempt to do so would be totally inconsistent with my position and self-respect" (Thomson, 1871; quoted in Hooker, Busk and Donnelly, 1873). Although generally considered an amiable man of charm and tact, with a tendency to defer so as to be congenial (Burstyn, 1972; McIntosh quoted in Gunther, 1977), in his correspondence regarding the museum Thomson seems prone to arguing his case particularly robustly; for further examples see his later correspondence with, and regarding, Albert Günther (Anon., 1877).

University Department or Public Museum?

It appears that Archer and Thomson each held strong and differing views of the role of collections. Archer saw the Museum as competing for its audience with other leisure facilities, specifically the public-houses. He wanted the Natural History Department to display large showy specimens which would attract the general public. Thomson wanted displays representative of the Animal Kingdom, appropriate to the needs of his students. He argued for substantial displays of invertebrates, which by and large are quite small and not particularly spectacular. (This dilemma about the target audience is one which continues to this day within the museum profession). Thomson seems to have determinedly set about trying to bring the natural history collection back under University control. Along with other Edinburgh professors, he argued strongly for this in the evidence he gave before the Royal Commission on Scientific Instruction (1874). Thomson was highly critical of the role of the Science and Art Department and made his view clear:

> "To take the National Natural History Museum of Scotland out of the supervision of the head for the time being of what the Commissioners admit to be the largest and most flourishing Natural History School in the kingdom and place it under the irresponsible control of a non-scientific man of Mr. Archer's status, - would have the worst possible effect on the school, and the progress of science for many years". (Thomson, 1873; quoted in Hooker, Busk and Donnelly, 1873).

This statement he made to a special committee, consisting of Joseph Hooker (Deputy Director of the Royal Botanic Garden, Kew, and a member, with Thomson, of the Royal Society's Circumnavigation Dredging Committee) (Burstyn, 1972), George Busk (zoologist and palaeontologist), and Major John F.D. Donnelly (Inspector for Science in the Science and Art Department), established by the Science and Art Department to try to resolve the conflict in their museum in Edinburgh. The committee wrote several reports between August 1872

and May 1874 (Hooker, Busk and Donnelly, 1873 and 1874), largely supporting the Department. Each was attacked by Thomson, one of Thomson's rebuttals being written aboard *Challenger* and posted from Lisbon (Thomson, 1873; quoted in Hooker, Busk and Donnelly, 1873). Eventually, tired of Thomson's campaign, the committee recommended:

> "... the appointment of a fully qualified naturalist under the administrative control of the Director of the Museum ... the Professor in the University being relieved of his responsibility as Regius Keeper" (Royal Commission, 1874).

Formal Separation of Professorship and Keepership

Thus in December 1873, as *Challenger* was rounding the southern tip of Africa, Ramsay Heatley Traquair, formerly Professor of Zoology at the Royal College of Science in Dublin, was appointed Keeper of Natural History in the Edinburgh Museum of Science and Art. This was a new post, which reported to the Director and had no responsibility to the University. Thus Thomson, despite holding a Royal Commission which specified life-time tenure of both posts, was relieved of all duties as Keeper and the University lost all control of the natural history collections.

The *Challenger* Collections

Following the return of *Challenger* there was, at times, an acrimonious dispute over how and where the *Challenger* collections were to be curated and the scientific results collated (Anon, 1877). The British Museum (Natural History) was anxious that the collections should be deposited there and that its staff should be fully involved in identifying and describing the material, but Thomson argued that the scientists responsible for collecting the material should be involved in the publication of the results of the expedition. Archer, perhaps fearful that Thomson planned to display the *Challenger* collection as a rival attraction to the natural history collections of the Edinburgh Museum of Science and Art, intimated these concerns to Albert Günther, Keeper of Zoology at the British Museum, who expressed his alarm to the Treasury:

> "I am inclined not to disregard the information which I received in the first instance from Professor Archer...and afterwards from several other sources, viz. that Prof. Thomson has the object in view to retain the principal part of the 'Challenger' collections permanently in Edinburgh, to form the foundation of a new Natural-History Museum" (Günther, 21st June 1876; in Anon., 1877).

Thomson responded angrily to Günther's accusation that he was attempting to appropriate the collections for his own purposes, and denied that he proposed to establish a new museum in Edinburgh, but rather, in due course as the collections were processed, he would probably recommend that a set of duplicate specimens "should be placed in the Edinburgh Government Museum" (Thomson, 2nd October 1876, in Anon, 1877).

Main Collections deposited with British Museum

Despite the British Museum's lobbying, Thomson convinced the Treasury that he should have full responsibility for the collections and their description, and that this work should be co-ordinated from Edinburgh, not London. The bulk of the collections, however, after being described by specialists of Thomson and John Murray's choosing (John Murray was one of the naturalists aboard *Challenger* and succeeded Thomson as Director of the Challenger Office), were eventually deposited with the British Museum (Günther, 1912; Lingwood, 1981).

Edinburgh Holdings

The relatively small amount of natural history material associated with the *Challenger* expedition which is held by the National Museums of Scotland is listed in Table 1. (Morrison-Low, elsewhere in this volume, discusses the N.M.S. holdings of instruments associated with the expedition). The natural history material comprises a number of collections donated by the British Museum (Natural History) as part of its programme for the distribution of duplicate specimens (Lingwood, 1981). In addition, there are some collections which seem to have been made privately by members of the expedition. His differences with Archer notwithstanding, after the return of the expedition Thomson himself deposited a number of small collections in the Edinburgh Museum of Science and Art and, following his death in 1882, both his widow and his son donated or sold a number of collections to the Museum.

University Concern

The University of Edinburgh was gravely concerned by the appointment of the new Keeper, and its consequent loss of control over the natural history collections. The lack of a museum for teaching purposes was one of the reasons given by Edwin Ray Lankester for his resigning as Professor of Natural History, just weeks after having been appointed as Thomson's successor in 1882 (Watson, 1969). Over the years, the University Senate raised a number of unsuccessful campaigns to regain control of the collections, the last following Archer's death in 1885 (Swinney, 1999).

Plate 3

The 'Bridge of Sighs' spanning West College Street to connect the University (right) to the Museum (left)

The 'Bridge of Sighs'

Symbolic of the relationship between the University and the Museum was the bridge, resembling the Bridge of Sighs in Venice, which spans West College Street connecting the University Old College to the Museum (Plate 3). It was originally constructed to allow ready access to the natural history collections by staff and students. The door to the bridge had been fitted with a lock prior to Thomson's appointment, but over the years the barrier to use of the bridge became increasingly permanent. In 1876 Archer expressed his concern that it might act as a conduit in the event of a fire in either building, and eventually it was permanently walled up.

In his history of the University, Alexander Grant (1884) observed bitterly:

> ".... in due course of time the official Director of the Museum succeeded in playing the cuckoo to the Professor of Natural History, and in ousting him from his function of Regius Keeper of the Natural History collections. At length it went so far that even the free use of specimens from the Museum for the teaching of the Natural History class was denied. And thus the physical connection of the 'Bridge of Sighs' which joins the two buildings of the University and the Museum, now chiefly serves the purpose of being a record of broken pledges".

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Table 1. Biological specimens in the National Museums of Scotland associated with H.M.S *Challenger*.
(Material associated with *Challenger* personnel but either known not to have been collected during the expedition or with no data to associate it positively with the expedition is marked with an asterisk).

EXTRACT OF REGISTER ENTRY[1]	SOURCE[2]	REGISTER NUMBER
'Collection of New Guinea & Australian Bird Skins and Mammals.'	Sir C. Wyville Thomson [by purchase]	NMSZ 1877.11*
'Hyalonema sibbaldi [and] Pentacrinus asteria.'	Sir W. Thomson	NMSZ 1877.26*
'Echinoderms, 32 specimens' [includes material from St. Georges Channel, Kings Mill Island, Caribbean Sea, Naples and North of Scotland].	Sir C. Wyville Thomson	NMSZ 1879.1*
'Starfishes' [7 specimens].	Sir C.W. Thomson	NMSZ 1879.63*
'Recent Invertebrata, 10 specimens from Bermuda.'	Sir C. Wyville Thomson	NMSZ 1880.33*
'Eggs of Foreign Birds...These specimens were collected by the late Dr A. Crosbie R.N. during the voyage of H.M.S "Challenger"' [4 lots listed].	Mrs Crosbie	NMSZ 1882.4
'A collection of Bird skins, fossils, skeletons, &c. 1078 specimens.' [Birds are mainly from Cape Town and Juan Fernandez].	Lady Thomson [by purchase]	NMSZ 1882.65* NMSG 1882.65*
'A collection of Fossil Echinoderms, 319 specimens.'	Lady Thomson [by purchase]	NMSG 1883.19*
'4 Specimens of Crinoids.'	Lady Thomson [by purchase][3]	NMSZ 1886.19
'A Collection of zoological specimens, comprising 96 Snakes, 6 Lizards, 12 Fishes, 142 Lepidoptera, 178 Coleoptera, and 77 Hymenoptera' [a few of the insects are from the *Challenger* Expedition].	Trustees of the British Museum	NMSZ 1895.94
'171 specimens of Echinoderms, Tunicata, Crustacea & Sponges, all duplicates from the Challenger collection.'	Trustees of the British Museum	NMSZ 1899.92
'A collection of Marine Invertebrates' [185 lots listed].	Trustees of the British Museum (Nat. Hist.).	NMSZ 1907.223

'Specimens of exotic Birds and Invertebrates'	Col. F. Wyville Thomson (son of Sir Charles, a surgeon in the Bengal cavalry)	NMSZ 1912.67*
'Two thousand two hundred and sixteen specimens of Exotic Coleoptera' [a few specimens recorded as being from the *Challenger* Expedition].	Trustees of the British Museum	NMSZ 1919.15
'The Lake Survey zoological collections, made by the Scottish Lake Survey under Sir John Murray, in Scottish Lochs; also Australian Marsupial Fossil remains; Christmas Island birds; Challenger Diatom Collection, etc.' [the diatom collection is listed in a supplementary register as comprising approximately 200 microscope slide preparations].	J.C.Murray and J.H Murray	NMSZ 1921.144
'Eighty-one bird skins collected by Dr. Alex. Crosbie, Staff Surgeon on the Challenger, during the Challenger Expedition; presented by Dr Crosbie to Mr. Wm. Evans, his brother-in-law.'	Mr William Edgar Evans	NMSZ 1923.58
'Eighteen bird skins which almost certainly have the same history as the preceding (1923.58) but lack evidence connecting them conclusively with the Challenger.'	Mr William Edgar Evans	NMSZ 1923.59
'Forty-one exotic birds' skins, all of brilliant plumage....from the collection of the late Wm. Evans – some or all probably given him by Dr. Crosbie (possibly bought during Challenger cruise).'	Mr William Edgar Evans	NMSZ 1923.60
'A Collection of Mallophaga, principally from the "Scotia" Expedition' [30 lots registered of which one is recorded as from the *Challenger* Expedition].	Miss Evans & Mr. W. Edgar Evans	NMSZ 1926.119
'A collection of Shells, etc, made by Dr. Crosbie, doctor to the "Challenger" Expedition' [142 lots listed].	Mrs Crosbie	NMSZ 1927.120
'"The Marine Mammals in the Anatomical [collection] of the University of Edinburgh... Cetacea" - see Sir William Turner's Catalogue'[4] [1956.36.48 - skull and mandible of *Mesoplodon layardii* collected in East Falkland by H N Moseley. Various other parts of the skeleton of this animal are registered as NMSZ 1981.57.532 and NMSZ 1989.63.1].[5]	The Senatus of the University of Edinburgh [Department of Anatomy]	NMSZ 1956.36
'A specimen of silaceous sponge, HOLTENIA CARPENTERI Wyville Thomson. Found unregistered and probably came in with the Thomson collection 1882/65 although it is labelled as being presented by Sir Wyville Thomson'. [Part of syntypic series collected by H.M.S. Lightning[6]].	Sir Wyville Thomson	NMSZ 1959.65*

'A collection comprising about 200 species of marine and non-marine Mollusca. Collected by Dr Alexander Crosbie, staff-surgeon aboard HMS "Challenger".... The shells were kept...for his private collection and were not included in the Reports....This collection complements that registered 1927.120.'	The Evans Trust [by purchase]	NMSZ 1972.50
'Bird skins and eggs from the collections of the late W. Edgar Evans' [60 lots including some from the *Challenger* Expedition].	The Evans Trust [by purchase]	NMSZ 1972.51
'A small collection of exotic insects, mainly Lepidoptera and Coleoptera, including some specimens collected by Dr Alexander Crosbie during the voyage of HMS "Challenger".'	The Evans Trust [by purchase]	NMSZ 1972.52
'Mollusca. Collected, probably by Dr. Crosbie, during the "Challenger" Expedition 1875.'	W. Evans	NMSZ 1978.19
'Articulated skeleton of subadult...Cephalorhynchus hectori...this specimen is presumably that stated by Hector (1885) to have been given to the Challenger collection and therefore...the specimen from Cape Campbell, Cook Strait, 1871.'	University of Edinburgh, Department of Anatomy	NMSZ 1991.17 (ear bones registered as NMSZ 1981.57.525)[7]
'Humpback Whale, Megaptera novaeangliae (Borowiski). 8 baleen and skeletal specimens found unregistered in the collection. Specimens collected between 1863 and 1913' [includes NMSZ 1991.89.3 a specimen from Queen Charlotte Sound, noted as part of the *Challenger* collection by Turner, 1912].[8]	donor/vendor unknown	NMSZ 1991.89.3
'46 anatomical preparations of mammals' [includes NMSZ 1995.19.38 - brain of *Mirounga leonina* collected by *Challenger* Expedition].	University of Edinburgh, Department of Anatomy	NMSZ 1995.19
'Skeletal specimens of marine mammals' [includes specimens of *Dugong dugon, Otaria byronia, Arctocephalus australis, A. gazella, A. philippi, Mirounga leonina* and *Leptonychotes weddelli* from *Challenger* Expedition[9]].	University of Edinburgh, Department of Anatomy[10]	NMSZ 1996.83
Giant clam, *Tridacna gigas*, reputedly collected during *Challenger* Expedition.	Rhoda Murray (grand-daughter of Sir John Murray) [on loan][11]	unregistered
Trepanned specimen of Cape mole rat, *Georychus capensis*. Specimen collected at Cape of Good Hope by *Challenger* Expedition.	University of Edinburgh, Department of Anatomy	unregistered

Notes:

1. Material enclosed in single inverted commas is transcribed verbatim from the N.M.S. registers; hence the apparently inconsistent use of italics.

2. As recorded in N.M.S. registers; hence the inconsistency of form.

3. Lady Thomson sold the Museum a further collection of 189 specimens of invertebrates, collected by Professor Michael Sars. They are registered as NMSZ 1884.37.

4. See Turner, 1912.

5. See also Herman, 1992.

6. See Smaldon, Heppell and Watt, 1976.

7. See also Herman, 1992.

8. Turner (1912) supplemented the '*Challenger* collection' with material which he described in his *Challenger* Report (Turner, 1880) but which was comparative material not actually collected during the expedition (see, for example, the sectioned tooth of *Mesoplodon bidens*, NMSZ 1960.11, which, according to Herman (1992), appears to be from a Scottish specimen).

9. See Turner, 1912.

10. Drawings donated to the Anatomy Department by Thomson and referred to by Turner (1912: 152-154) are not in the N.M.S. collections (J.S. Herman, personal communication).

11. David Heppell, personal communication.

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A GROUNDING IN SCIENCE?
JOHN MURRAY OF THE *CHALLENGER*, HIS GRANDFATHER JOHN MACFARLANE, AND THE MACFARLANE MUSEUM OF NATURAL HISTORY AT BRIDGE OF ALLAN

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Introduction

On 8th November 1860, John Macfarlane of Coney Hill, Bridge of Allan, near Stirling, wrote to his fellow Scot, agent and confidant, Captain Thomas Brown of Manchester:

> "I am favoured with yours of the 6th and 7th inst. with particulars of a package containing the Lioness and other items. I would have sent you the skins to which I referred in my last letter.....but Stevens has not sent all he had. I believe however they are now on the way, shipped by one of the Graingmouth Boats. This is now the cheapest and easiest way for goods coming from London to this quarter. Graingemouth is only about 12 miles distant from this, and has very recently opened a direct Railway Communication to the Bridge of Allan.
>
> I had my Museum visited a few days ago by Mr. Stirling of Keir, accompanyed by Lord John Manners. They had no conception that so large a collection of Natural History existed in this part of the world. They particularly admired the Himalaya pheasants, particularly the Spotted Horned one. It is certainly the Gem of all my other birds.
>
> I have given to John Murray the particulars of your statement concerning Grey's Genera of Birds and I hope he will profit by it. The third story of the new Building is about finished and [I] expect to commence the roofing in the course of next week
>
> I notice what you state of having written to Mr. Stevens about the Tiger Skin. I had written to him about it also, nearly in the same words as you have done. I have given him an order for the following if got cheap, viz.:

> Flying Squirrells (I have only one good specimen of this), the Australian Pelican, the Kangaroo and also a couple or two [cases] of the Butterflies and Moths, the latter only on condition that they are got for an old song, a job price in his estimation. He knows pretty well what I mean, the chance of their being many duplicates amongst them.
>
> I remain my dear Sir &c., &c.
>
> P.S. The box with the sundry Items from Graingemouth has arrived since I wrote the annexed. JMcF." (1).

The surprise expressed by Macfarlane's aristocratic neighbours at discovering a burgeoning museum of natural history on their doorstep, may be shared today by those currently interested in the development of natural history and natural history museums in nineteenth century Scotland. When the Macfarlane Museum of Natural History at Bridge of Allan was disbanded early this century, its existence was soon largely forgotten, except in the locality, and by those interested in the life and work of Macfarlane's grandson, John Murray, who went on to become an important scientific figure. Impressive amateur natural history collections were not uncommon in Victorian times, but though some still survive today, enshrined in local and national museums throughout the British Isles, others have vanished without trace, making it difficult to assess their true significance.

This would have been equally true of the Macfarlane Museum, were it not for the survival of a letterbook preserving copies of its founder John Macfarlane's correspondence between 1860 and 1863 (2), the time when his most ambitious project was nearing completion. This is preserved in Murray's scientific papers, donated after his death to the Natural History Museum in London. Murray, as a young man, himself copied most of the items into the book, while acting as his grandfather's assistant and curator of his natural history museum. The letters are of great interest for the information they provide about this little-known period in his early life, though he himself is always a somewhat marginal figure in the correspondence, which is dominated by the personality and preoccupations of his grandfather, John Macfarlane. Chief among these was the museum, the principal undertaking of the last years of the older man's life. However both the grandfather and his museum exercised an enormous influence on Murray's personal and scientific development which has never been fully assessed, partly for lack of evidence. The contents of the letterbook enable us to obtain a much improved understanding of how events in this period of Murray's life set him on the road to what would become a distinguished scientific career.

Of particular importance in this respect is the information the letterbook contains about the Macfarlane Museum of Natural History, about which little has hitherto been known, at a time when both building and collections were in the process of being asssembled. The correspondence reveals that the impression given in some more recent accounts, that the museum was a private and amateur affair of purely local significance, needs to be revised. It was indeed designed to act both as an important local tourist attraction, which it clearly was, at least in the short term, and an educational resource, a role in which it was rather less successful (see Note 65). But John Macfarlane aspired to create an institution with the potential to achieve national or even international status. In 1861 he wrote:

> "If my trustees after my death do their duty and continue to add to this collection of mine, with the funds I have for that purpose, my museum must in time become the next largest to the British Museum in the 3 departments, lst of Quadrupeds, 2 Concology [sic] 3 Ornithology" (3).

Even if we take some of Macfarlane's more extravagant claims for his museum with a pinch of salt, the letterbook presents a new opportunity to examine this remarkable institution and see what it really was and why it failed to achieve the lasting existence its founder hoped for. Macfarlane was a pragmatist, and was well aware that his plans could not take care of every eventuality. To the letter quoted above he added the caveat, "the best of schemes of mice and men gae aft...aglee". So what went wrong, and why has the Macfarlane Museum not survived to the present day?

The letterbook helps us to obtain a fuller picture of the museum's rise, and though its decline belongs to a much later period, may well also highlight factors which would ultimately contribute to its downfall. Whether Macfarlane's scheme was grand or merely grandiose is still ultimately hard to assess since his creation has so completely disappeared, but at least there is now something to go on. The letterbook gives abundant insights into Macfarlane's plans, and how he went about putting them into execution. It contains detailed information about the day-to-day progress of the fabric of the building, as well as the exhibits which were being installed, and how they were acquired. The letters also deal with John Macfarlane's other interests, particularly his business and charitable activities, and incidentally they tell us a great deal about his personality and the philosophy and ideals which led him to engage in his various enterprises, with a vision that was at once far-sighted but flawed. This information, while seemingly unrelated to the museum, is nevertheless highly relevant to its development, uniting as it did aspects of many of

Macfarlane's other activities. Its story can only be fully understood by taking into account the life history, motivations and personality of its founder.

The letters are, indeed, well worth studying for the picture they give of an interesting and often controversial figure, and his relationship with the local community, as well as for the fascinating account they provide of the genesis of a Victorian museum. However, it is not just the fact that they enable us to examine in detail how the museum was planned, built and stocked, in addition to the character and business and philanthropic interests of its founder, which make them of such interest today. While John Macfarlane is important mainly as a local rather than as a national figure, the story of his mueum takes on a wider significance because of the involvement in it of his grandson John Murray, who would become a pre-eminent figure in the science of oceanography as the century drew to a close.

Murray and Oceanography

Sir John Murray (1841-1914) was one of the foremost British scientists of the early twentieth century, recognised both at the time and since as a world leader in the young science of oceanography. Born in Canada, he came to Scotland in his teens. In 1872 he was selected to join a team of naturalists sailing on a three-year voyage round the world in H.M.S. *Challenger*, the first major expedition dedicated to the scientific exploration of the sea (Deacon, 1997). Murray made a major contribution to the scientific investigations undertaken during the voyage, including a pioneering study of deep-sea sediments. However, it was the work he did as editor after the expedition's return, in completing publication of the vast natural history and other collections in the 50-volume *Challenger Report* after the early setback of Wyville Thomson's death, that was so essential in securing the expedition's lasting impact on the development of marine research. The completion of this great project, in 1895, brought Murray international recognition and honours, in addition to his British knighthood and election as a Fellow of the Royal Society of London (see Plate 1).

The work was based at the Challenger Office in Edinburgh, and Murray founded the Scottish Marine Station for Scientific Research at Granton (Deacon, 1993), the world's first oceanographic institute, to carry out related researches in Scottish waters. Unfortunately the station failed to secure essential governmental support and was shortlived, and even the funding for the *Challenger Report* had dwindled away before it was concluded. Towards the end of his life, Murray became a wealthy man, and profits from the exploitation of phosphate deposits, discovered as a result of his work on marine sediments, enabled him to finance new research (Burstyn, 1975). In these later years he maintained a private laboratory at

Plate 1

Sir John Murray
in later years

(Photograph by permission of the President and Council of the Royal Society of London)

the Villa Medusa, near his home Challenger Lodge (now St. Columba's Hospice), on the banks of the Forth at Granton. However, even in the lean years of the later 1880s and 1890s he was still active in numerous projects for the advancement of the scientific and geographical knowledge of Scotland in the widest sense, from the weather on the tops of the hills, to conditions in the depths of the adjacent seas. With his colleagues from the Marine Station, he explored the physics and biology of the Firths of Forth and Clyde. He was jointly responsible for, and scientific director of, the Bathymetric Survey of Scottish Lochs, carried out in the late 1890s and early 1900s (Murray and Pullar, 1910), and was closely involved with the Scottish Meteorological Society's Ben Nevis Observatory throughout its existence. In the wider field of oceanographic research, he put forward an alternative explanation (to Charles Darwin's) for the formation of coral reefs and atolls, which gained wide acceptance in the early 20th century. Though his own sea-going research after the *Challenger* was hampered by lack of funds, and it was not until 1910 that he was able to hire the Norwegian Fisheries Vessel *Michael Sars* for a cruise in the North Atlantic, he was always a great traveller, and his home and laboratory acted as a magnet for fellow-workers from home and overseas. Through his own work and publications, and this wider network of friends and colleagues, Murray's influence on the rapidly developing science of oceanography continued to be strongly felt, long after his death in a car crash in 1914.

The story of Murray's life and achievements are well known in outline, but he has never been the subject of a full-length biography. An excellent summary by W.N. Boog Watson (1967) provides the most recent account of his life. Some aspects of his career have since been studied in more detail, especially the acquisition of his fortune through phosphate mining (Burstyn, 1975). However, for such a major and influential figure, he has received relatively slight attention, even from historians of oceanography, and there are facets of his life and work which are little known (4), in particular the period between his arrival as a youth of 17 to live with his grandfather in Bridge of Allan, and his departure with the *Challenger* some 15 years later. How did the young man who had left his native Canada as a schoolboy develop into the scientist and naturalist whose special talents led him to be selected over the heads of ostensibly better qualified individuals to make the *Challenger* voyage?

We know from Murray's own words how great was the effect upon him of his first experiences of the ocean, and the contrast between it and the plains and Great Lakes of North America, on whose shores he had lived as a child. In an address given in 1899 to the pupils of Stirling High School, where he had attended classes following his arrival in Scotland, he described its impact:

> "When I left that early home....I had not yet seen the ocean. The voyage across the Atlantic made a great impression on me, so different was the salt, rolling sea from the great fresh-water lakes with which I had up to that time been familiar. I was fascinated by the daily operations of the officers on the bridge when taking the altitude of the sun at mid-day. On witnessing the rise and fall of the tide for the first time on the West Coast of Scotland, the impression was still more profound. The great laminarian sea-weeds uncovered at low water, the hundreds of many-coloured marine creatures abandoned by the sea, and, withal, the peculiar smell was something I had in no way anticipated. On this particular occasion, it seemed to me that something had really gone wrong, that a great catastrophe had happened, and I watched with some anxiety for the turn of the tide. You have all been familiar with this extraordinary phenomenon from your infancy, and its grandeur does not strike you. To me, seeing it for the first time at the age of fifteen, it was impressive as we know it was to those early Greeks who first sailed from the tideless Mediterranean through the Pillars of Hercules....The great globe seemed to me to be alive, and the rise and fall of the tide was its breathing!" (5).

Yet the route which Murray followed between that revelation and setting sail in the *Challenger* was hardly a conventional one, even by the standards of the time, and if his career had followed a more normal pattern it is unlikely that he would have gone at all; certainly such an outcome could not have been foreseen. His love of the sea and ships manifested itself in various ways during those years, but for a decade following his arrival in Scotland, his time was divided between studies at academic institutions (at Stirling High School and Edinburgh University) and assisting his grandfather as curator of the museum. It was the tension between these two occupations that, as will later be seen, ultimately led to their falling out with one another. Murray himself referred to these past events, in terms echoed in articles about him and in his obituaries, with accuracy but briefly. Dislike of self-advertisement, coupled with family loyalty and gratitude for what the older man had done for him, would all have enjoined discretion. However, it was not exactly secret that John Murray and his grandfather did not see eye to eye over his intended career. Disputes of this kind between the generations were far from uncommon in the social circumstances prevailing at the time, but this disagreement between grandfather and grandson is of greater interest as part of the chain of circumstances that led to Murray's joining the *Challenger*. The subsequent glossing-over of this episode by himself and others has contributed to the disappearance of an interesting episode of Scottish natural history and local museum development, one that is important not only for assisting an understanding of Murray's career and the acquisition of the various, and in many ways

unconventional, skills which made him such a useful member of the expedition, but also for what it tells us about the remarkable museum at Bridge of Allan, and its creator John Macfarlane.

John Macfarlane

The Museum of Natural History at Bridge of Allan was the project of John Macfarlane's declining years, but in many ways it represented the culmination of ideas and initiatives which he had developed much earlier and which found expression in a number of interlinked activities which occupied him in maturity. To understand how Macfarlane came to undertake this particular scheme, in his old age, and what he was trying to achieve through it, it is necessary to know something of his previous history, and his personality (6).

In 1860 John Macfarlane was 75 years old. Born in Stirling in 1785, he was a self-made man, "trained for commercial pursuits" (7) who began work in Glasgow at the age of fourteen. This does not mean that he was working-class in origin; his relatives spanned the broad divisions of the middle classes, and some were gentlemen, among them Major Henderson and his brother, Sir James Alexander (1803-1885) (8), who owned the estate of Westerton adjoining Bridge of Allan, and were themselves related to former provosts of Stirling. However, it was in Manchester, where he is listed as a commission agent (9), that Macfarlane made fortunate property investments in the area which later became the city centre. By the late 1840s he was sufficiently well off to be able to retire to his native Scotland, where he bought the small estate of Coney Hill on the edge of the growing spa town of Bridge of Allan and began to develop it as a suburb, building houses for rent to visitors and workmen's cottages.

Macfarlane, however, was not just interested in making money, though he had a keen sense of its value. He was thoroughly imbued with the early nineteenth-century tradition of philanthropy, and many of his schemes were intended to promote the physical, intellectual and moral welfare of the inhabitants of his native town and its environs, and to enhance its civic amenities, as well as its economic prosperity. His activities as a benefactor to Stirling began well before his return to Scotland, and were initially linked to his own special talent for textile and fabric design, success in which, according to his obituary in the *Stirling Journal and Advertiser*, laid the foundation for his future prosperity (10). In the 1830s, while still in Manchester, he was involved in discussions which ultimately led to the setting up of the school of design at Somerset House in London, and he was anxious that Stirling should enjoy a similar advantage (11). As he later recalled:

> "It was in the year 1839 that at the expense of nearly Four Hundred pounds, I sent down to Stirling the Material consisting of Plaster Casts and original paintings in order to form a school of design in my Native Town...Here then was an opportunity for my Town being the first in Scotland to distinguish itself seven years before it was thought of in Edinburgh, Glasgow, Paisley, Greenock, or any other place" (12).

To his abiding disappointment the town council failed to act on his suggestion, so in 1843 the collection was moved to Bridge of Allan and exhibited there in a hall specially built by his relative Major Henderson (Rogers, 1859). In 1855 Macfarlane established a Free Library for working men in Stirling (13), to which he added a small museum of antiquities (14). He contributed generously to many local projects; for example, in 1856 he gave £500 to endow prizes and a championship cup for the Stirling Regatta. He headed the subscription list for the Wallace Monument and always maintained that the idea originated with him (15). Later, however, he declined an invitation to the laying of the foundation stone, both on the grounds of health and because he disagreed with the chosen design, though he does not seem to have carried out his threat to withdraw his contribution (16). Controversy indeed was never far from his various undertakings; Macfarlane gave generously, but not unconditionally. If he felt a situation had been misrepresented, or his funds were applied in ways he deemed unsuitable, he protested. Things had to be done his way.

Public-spirited as Macfarlane's proposals were, they were combined with the instincts of the developer. He campaigned for a new Forth and Clyde Canal, and for a tramway to link Stirling with Bridge of Allan, which he believed would continue its rapid expansion of the 1860s and was eager to see yet further developed as a new town and important tourist resort (17). The Museum of Natural History formed an integral part of these schemes, and was the principal object of Macfarlane's attention during his later years. It occupied a middle ground between his philanthropic projects and his more speculative activities, and had aspects of both. It developed to include an art gallery, the sculpture exhibition already at Bridge of Allan, and a library and reading room, the whole forming a central part in his wider schemes for the expansion of the town. However, the nucleus of this development was the Macfarlane Museum of Natural History, both as an attraction which would draw visitors and residents to the area, and at the same time provide a livelihood for his grandson, John Murray, recently arrived from Canada. Clearly, however, Macfarlane also enormously enjoyed setting up the museum. Murray's subordinate role was initially in keeping with his youth and inexperience, but as both he and his grandfather grew older, this would lead to friction between the two men.

The young John Murray

John Macfarlane's desire to be in control had its effect on his family life, as well as on his business and charitable activities (18). He had disapproved of his daughter Elizabeth's marriage to Robert Murray, an accountant (19), and this seems to have been the reason for their emigration to Canada. John Murray, the second of their two sons, and presumably named after his grandfather, was born in Coburg, then in Upper Canada, on the shores of Lake Ontario, in 1841. His elder brother James later worked for the Canadian Pacific Railway, and there were also five sisters. Murray's childhood was divided between Coburg and London, Ontario, where he went to school. In 1856 he was admitted to the preparatory department of Victoria College (20), but the following year, his father having died, he was invited to Scotland by his grandfather who offered to provide for him. In 1858, aged 17, Murray crossed the Atlantic and became a member of his grandfather's household in Bridge of Allan (see Note 5).

As we have already seen, Murray often referred to the lasting effect of the sea crossing upon his imagination, but the new landscape surrounding his grandfather's house at Bridge of Allan also had a strong influence on him. He later said: "All my Natural History was commenced there, and I also made a fine collection of the plants and birds' eggs of the district" (21). The excitement caused by the excavation of a whale skeleton at Cornton, and an Irish Elk at Stirling Bridge, not to mention the discovery of a prehistoric burial, led to a lasting fascination with the distinctive geology and landscape of the area. For two years after his arrival he also attended classes at Stirling High School. These encouraged him to dabble in science with boyish enthusiasm, and sometimes disruptive consequences (22), so much so that his experiments with electricity were banned and he was requested to confine his activities to botany, zoology and geology. The impact upon him of the environment of the Forth valley was both important and lasting. He later wrote:

> "It is always with emotion that I now look down on the valley....for I see stretched before me the scene of my first explorations, and my first collections. Here the desire to travel far and wide over the surface of the earth originated. Here grew up the desire to become personally acquainted with men engaged in the study of nature" (23).

Much has been made of the *genius loci* as an influence in literature, less so perhaps in science.

The generally accepted account of the formation of the Macfarlane Museum of Natural History is that John Macfarlane established it in response to his grandson's

interest in this field. He certainly at some stage decided that the museum should provide a permanent occupation and livelihood for the younger man when he himself died, but the evidence that this was his original intention in setting up the museum is less clear.

Indeed the letterbook shows that Murray's role in the original concept of the museum may not have been quite as central as has been previously supposed. It contains evidence that his involvement may have come as an afterthought, or at least that his activities were not the only factor leading to the museum's establishment. Macfarlane had already set up both an art gallery and another museum, of local history, before his grandson came to live with him, and, as will be seen below, at one point gives a rather different version of the foundation of his natural history collection. Though Macfarlane's version may well have been coloured by circumstances pertaining at the time, the older man's obvious delight in the project and its associations with links formed earlier in his life, support the idea that Murray's youthful enthusiasm for natural history was not the only reason why his grandfather entered into the project. Though Murray's contribution to the museum was a very considerable one, both through the medium of his own local collections and as Museum Curator, the ideas and philosophy behind it belonged to his grandfather, who also provided the money needed to give these ideas physical expression.

This entails some revision of existing notions. Because of Murray's youthful enthusiasm for natural history and his presumed central role in the project, it has usually been assumed that 'museum' in this context signified a boyhood collection of largely local significance and limited general interest. The new evidence suggests both that the reason for the museum's creation was the enthusiasm not so much of youth but of Macfarlane in old age, perhaps taking advantage of an opportunity which circumstances had hitherto denied him, and that the resulting institution was of some significance, interesting in its own right and not just because of the Murray connection. To suggest that Murray's role in its proceedings was slightly different than has hitherto been assumed, however, is in no way intended to diminish the very real significance of these years in his own personal development as a scientist.

To conclude, his own enthusiasm for these pursuits may well have encouraged his grandfather in the idea of founding a natural history museum which would be something more than an extension of Murray's youthful enterprises. It was the hobby of his grandfather's declining years, in which he brought together aspects of his earlier foundations. The scheme combined the older man's desire to promote the spread of learning, and the aggrandisement of his locality, together with

potential commercial benefits. However Macfarlane's letters also reveal his abounding enthusiasm for the project. Though he designed it to be Murray's life's work as its Curator, in reality it was the Macfarlane Museum in more than name. He was the driving force and made all the important decisions, as well as spending considerable amounts of money on it. In its day it achieved some local fame but, as with previous schemes, Macfarlane's hopes were only partially realized, and as far as his grandson was concerned, eventually frustrated.

The Origins of the Macfarlane Museum of Natural History

Though Murray's future may have been part of his grandfather's master plan, it is possible that this was an afterthought and that the origins of Macfarlane's idea for the museum lay elsewhere. He may even already have embarked on the project before Murray's arrival in Scotland in 1858, and it is conceivable that his developing plans suggested the idea of sending for him. As seen earlier, by the time the letterbook opens late in 1860 (24) the museum was already open to visitors in temporary accommodation, and a new building to house it was at an advanced stage. Though Murray's enthusiasm for natural history may well have influenced these plans, Macfarlane himself also had a long-standing interest in its study. In a letter to Lord Brougham in 1863 he says of the museum that "This is the labour of my last few years, but I have been cultivating Natural History for a much longer period" (25). While in Manchester he had been a member of local scientific societies, having joined the Manchester Literary and Philosophical Society as early as 1823, and during the time he was building up the museum in Bridge of Allan, he relied greatly on help and advice from a friend from his Manchester days, Captain Thomas Brown, whose role in its creation was a crucial one.

Thomas Brown had been appointed Curator of the Manchester Natural History Society's Museum in September 1838 (Jackson, 1944). He was a Scot, born in the same year as John Macfarlane, 1785, in Perth, who had developed an interest in natural history as a boy and later specialized in conchology. He joined the militia and served in Ireland, but his regiment, which was briefly also stationed in Manchester, was disbanded at the end of the Napoleonic Wars. He invested his money in a flax-spinning mill in Fife, but this burnt down, so he then moved to Edinburgh where he made a living by writing and illustrating books on natural history. The study of shells continued to be his main speciality and he accompanied James Smith of Jordanhill on a dredging expedition in the Firth of Clyde in 1837. The move to Manchester took place the following year, and he held the position there until his death in October 1862.

During the two years preceding Brown's death, John Macfarlane wrote to him almost every week, and sometimes more often, on business connected with the museum. Though the two men had overlapped in Manchester for a relatively short space of time, perhaps only seven years (1838-45), they became great friends. As someone without detailed knowledge of natural history, or of curating collections, Macfarlane relied heavily on Brown's advice and assistance, both in the purchase of zoological specimens and in their preparation and display. After Brown's death, however, he acknowledged an even greater debt to him, writing to Mrs Brown:

> "...my own loss....is more than I can express. It was entirely...your husband's good offices that enabled me to make my fine collection in Natural History. In fact I may state that he was its founder and whatever merit there is shown in its formation it is entirely his" (26).

In a letter to Samuel Harrop written four days later, he says of Brown that "it was at his recommendation and desire" that the Museum was started, and that he donated the original specimens, and followed these with further items which were not required for the Manchester Museum.

At the time when the letterbook commences, in November 1860, Macfarlane was in the process of erecting a new and much larger building for the museum, next door to his own residence, in Edge Hill House, one of the new villas he had built at Coney Hill (27). Although the building was still under construction, he was also eagerly collecting natural history specimens, anticipating the expanded displays that the extra space would permit. At the same time he was purchasing books on natural history to aid John Murray in his curatorial duties, as well as books for the Free Library, and paintings for display in the museum. How were the natural history specimens obtained, apart from Brown's generous gifts? We know that items from Murray's own locally acquired natural history collection, including minerals, were in the museum, but a considerable number of the specimens displayed were actually purchased, and the letterbook enables us to see how this was done. Macfarlane acquired most of his specimens through the London dealer, J.G. Stevens, and employed Brown as his agent and intermediary. We can follow in detail how the collection progressed from 1860 to 1863, and the extracts quoted below form only a small sample of the correspondence on this topic.

In November 1860 Macfarlane wrote to Brown, in what is a fairly typical letter:

> "I am glad...that you consider that I have got a good bargain of the Griffon Vulture...I wish you to send what skins you have ready stuffed to put J. Murray's hand at work...arranging them" (28).

Plate 2

Letter from John Macfarlane to Lord Brougham,
1st October 1863,
written on the headed notepaper of the

Macfarlane Museum of Natural History

This letter is in John Macfarlane's own hand,
unlike most of the entries in the letterbook
which were made on his behalf by John Murray.

(Reproduced from the Brougham Papers, 5375,
by kind permission of the Library of University College London)

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BROUGHAM MSS.

Macfarlane Museum of Natural History.

Library and Reading Room
and Gallery of Paintings, Marble Sculpture and Casts from the Antique
MACFARLANE TERRACE COMELY HILL.

Bridge of Allan East 1st October 1863.

My dear Lord Brougham & Vaux

Late Lord Chancellor of England &c &c &c

My dear Lord

Of my inability to acknowledge (except privately on your Lordship's arrival at Edinburgh) your kind favour of October 1st, I have no other way of communicating to your Lordship than this of telling you know what efforts I have made in following out your long entertained views for the improvement of our Teaching Classes; knowing it may be of interesting to your Lordship

To your Lordship's information I take leave to state, that in 1855. I instituted a Free Library in connection with the Stirling Mechanics Institution being the first Free Library instituted

I believe

Macfarlane had the skins he purchased sent to Manchester to be stuffed by the taxidermist used by the museum, but after a while he wondered if he should not employ one of his own. He wrote to Brown asking for his advice on this:

> "Do you not think it would be well for my Museum to have a stuffer attached to it? The time may come when your Manchester stuffer will not be to be had" (29).

Macfarlane regularly complained to Brown about Stevens. For example, on 16th November 1860 he wrote:

> "He has not purchased all I ordered, and he has sent some I did not order. I wanted very much to have got the alligator's eggs and he has not bought it...I cannot help remarking that when I select articles which I consider to be very rare I never get them. These seem to be reserved for other customers. We must give up purchasing until I get more room to store them in".

However, he was unable to resist the temptation of further catalogues, and such resolutions were often made only to be broken next time a particularly desirable item appeared. In 1861 he was also negotiating to obtain specimens from fatalities at the London Zoo, through the Curator P.L. Sclater (30), though it does not appear that any specimens actually came from this source (31). With the prospect of such additions, Macfarlane felt that:

> "...this with the other sources which I have bids fair to make my Museum the first of its kind in Scotland, if perhaps it is not so now. The Museum is such an acquisition that it cannot fail to give an increased popularity to the Bridge of Allan, indeed at present I know of no watering place or other places in either England, Scotland or Ireland where visitors congregate that possesses an object intellectually equal to it" (32).

The museum's exhibits were designed to cover all the larger or more striking members of the animal kingdom, in particular mammals, birds and reptiles, but it also contained insects and other invertebrates, as well as a shell collection. Macfarlane, however, had a decided weakness for the more impressive displays. He wrote to Brown in December 1860: "I wish the Tiger had been a little larger" (33), and, a week or so later: "The want of a splendid specimen of the Bengall Tiger is a great deficiency in my collection" (34). This continued to occupy him, and in his next letter to Brown he wrote:

> "A Bengall Tiger appears to me the most prominent want at present, a full grown Ostrich and a Kangaroo to follow will be requisite. [However] I am so much hampered for room that I must decline the purchase of a snake skeleton. We are now busy furnishing the interior of the New Building and untill it is completed we are kept in confusion for want of space for the Birds which are not in the case at present" (35).

A month later he was writing:

> "John Murray has got more Birds to prepare for the New Building than he can well manage and I see everything is in great confusion from the want of room. You will not buy any more until we can get into the New Building" (36).

However he continued to order other items and wrote to Stevens the very same day with instructions to purchase a large Armadillo, "provided it is a large one", a Brazilian cat and Coatimundi, a vulture and a Vampire Bat etc.

> "Meantime I will thank you to advise me if the Leopard contained in Case (Lot 396) is a full-grown animal of large size and your opinion as to the value of the case" (37).

A month later he was writing:

> "I notice [lot] 291 is a specimen of a stuffed Boa Constrictor. I want one but of the very largest size that can be procured, having in my museum smaller specimens" (38).

By April 1861, however, he felt that a stage had been completed. He wrote to Stevens:

> "My Museum is now fully made up with the ordinary objects which similar institutions contain. I must now purchase specimens that are most rare and also some others which I am still in great want of" (39).

This included another lioness He wrote to Brown:

> "Although I have got a lioness, and a very fine one too, I should like another if in a lying down position, merely for the sake of having the male and the female so grouped" (40).

The one that was on offer proving unsuitable, he decided to wait for another one, which could be arranged with the two cubs he already possessed "crawling over and round her".

The excitement of these purchases, however, was quite overshadowed by the sudden opportunity to acquire an Elephant. In June 1861 Macfarlane wrote to Gordon-Cumming ('the lion killer'):

> "This morning the Tradesmen are commencing laying along my Museum the iron pipes by which it will in future be warmed with steam and the usual fireplaces removed. As my Curator Mr. Murray will be engaged during the operations he will not leave until this is completed... I have some intention of sending him to Glasgow to go round by the Inverness steamer that he may see the Caledonian Canal throughout to Inverness and from thence per steamer to Granton.
>
> Since I addressed you last I have got a young Elephant which died very recently...in a travelling Menagerie, and which my friend Captain Brown of the Manchester Museum of Natural History, most happily secured to me" (41).

As well as purchasing specimens at auction and from dealers, Macfarlane used any opportunity to obtain specimens, whether from menageries at home or friends abroad. In July 1861 he wrote to Thomas Brown (in the letter announcing the arrival of the Elephant);

> "I have had a letter from Lady Alexander at Auckland, New Zealand, where Sir James is stationed with his Regt. She has been indefatigable in trying to procure specimens of anything rare in Birds and animals, and has employed the several officers in the regiment to procure them for her whilst on their shooting excursions, but hitherto with little success" (42).

Apparently it was not a productive area. He had better hopes of a possible contact in the town of Nelson, which "possesses an institute in which is exhibited objects of natural history" (43), and later the same year also wrote to the naturalist E.L. Layard, who had recently been appointed private secretary to the new governor, Sir George Grey, about his wish to acquire further specimens of *Apteryx*, adding:

> "For your information I have formed on my property here a Museum of Natural History, I now believe to be the largest of its kind Either public or private in all Scotland" (44).

Macfarlane's emphasis on trying to make his natural history collections as comprehensive as possible was in accordance with current practice, on which Brown would have advised him, as museums sought a more scientific and educational role, moving away from the collections of miscellaneous 'curiosities' of an earlier date.

The Expansion of the Museum

All this time, work on the new building was still going on. In November 1860 Macfarlane was complaining to Brown that "my Workmen get on very slowly, do all I can to push them forward" (45). However, by the end of the year the exterior of the new Museum was almost complete and he told Brown:

> "We have got the roof of the new Building complete nearly all except the glass...and are proceeding with the furnishing [of] the interior" (46).

There were further delays with the glazier (47), but by May 1861 Macfarlane was weighing up the relative merits of different central heating systems, either hot air or steam (as seen earlier, he chose the latter). In July 1861 Brown proposed to pay him a visit and catalogue the shell collection, while the Manchester Museum was being repainted, and Macfarlane wrote to him:

> "I shall (I have no doubt) in the course of this week have the museum in such a state as ...will not interfere with your progress in completing the arrangement of the Conchological department" (48).

However, he was still not satisfied with the extent of the new building, partly because he had decided to include not only the paintings which he was collecting at the same time as the natural history specimens, but also to move his collection of statuary, hitherto displayed elsewhere in Bridge of Allan. He wrote to Brown in November 1861:

> "I am preparing the ground for a further [extension]. I intend making the rooms 60 feet in length, the two lower rooms for Natural History, the top flat lighted above, as that of the Gallery of paintings for holding my large collection of casts from the antique and marbles" (49).

He was also adding a porter's lodge, which caused repercussions from his neighbours since the museum was being constructed very near to the border of his land and the boundary was in dispute. All these additions took time, and in

Plate 3

The Museum Hall, Bridge of Allan
Constructed 1886-87

At the time this photograph was taken, the old (1860s) Museum building was still standing. Part of it is visible on the top left of the photograph.

(Photograph by courtesy of Mr. J. Malcolm Allan)

December 1861 he told Brown that the building would not be ready until next spring.

By this time the Coney Hill settlement included about a dozen villas, and a row of workmen's cottages was under construction. Macfarlane decided that they also needed a shop, and suggested to the local Bridge of Allan grocers that they should open a branch there, forecasting that its business would increase as the "new village or town of Coney Hill" expanded further. There is much in his letters about this proposed development which he says, at his advanced age, he does not expect to see, but which would in time emerge if his trustees carried out his wishes faithfully.

He regarded the museum as the key to the success of this wider venture:

> "My Museum of Natural History is getting everyday extensive additions and the circumstances of its having been visited by not less than one thousand visitors and others this year will bring this eastern part of the locality more into public notice, more particularly as I intend to add to it a Reading Room which with my gallery of paintings will form such an agreeable lounge as cannot fail to induce families to take up their residence in its neighbourhood. No other spa or place of resort possesses so valuable [an attraction] as this is and so well adapted to bring Regular annual visitors to it" (50).

His belief that the presence of such a museum would be influential in attracting tourists as well as new residents to the area, needs to be viewed in the context of the well-documented mid-nineteenth century middle-class enthusiasm for natural history studies (Allen, 1976), coupled with contemporary interest in schemes for self-improvement. As many of his projects demonstrate, John Macfarlane was strongly committed to furthering the latter aim, but his powerful entrepreneurial instincts equally saw the commercial possibilities in catering to fashionable tastes. Though his museum was not intended as a local museum, and indeed predated many of them (the Perth Museum, for example, was opened in 1895), it may well also be considered as a precursor of similar institutions designed for a more specifically local role, such as the slightly later Smith Institute in Stirling. His appreciation of the potential of a natural history museum as tourist attraction was certainly not unique, as the decision of Brighton town council some decades later to acquire the Booth Museum (Flower, 1898: 70-73) illustrates. Though Macfarlane was willing to subsidise his museum to a considerable extent, his enterprise perhaps has most in common with other contemporary or near-contemporary attempts to combine more or less serious natural history with public

entertainment in projects intended to be commercially viable. This would enable it to be compared not just with other museums, but also with the public aquaria which became such a popular feature in the 1870s (as they have again in the 1990s), and there are many similarities between them.

In common with these somewhat later institutions, although the central feature of the emerging complex was the natural history museum, Macfarlane was already adding to this nucleus other attractions which could be expected to have a more general appeal. As early as December 1860 he was talking in an ill-tempered way about moving his Free Library from Stirling to Bridge of Allan, complaining that "the middle and better class of the inhabitants of the town" had never taken any interest in it. He did not carry out this threat, but by early 1861 was thinking about adding a library to the museum complex. He was already buying books on different topics for the Free Library, and also books on natural history for Murray, to help him in his curatorial work. The library and reading room to be attached to the museum, however, do not seem to have been designed to be linked to the displays themselves, but rather to enhance the museum's general attractiveness to visitors.

This was equally the case with the paintings. Macfarlane sought an agent in London to buy landscapes and historical scenes; none was to be of a religious character, and he was not to pay a great deal for them (52). This would not matter, he observed to Thomas Brown, since most people could not tell the difference, and:

> "I have not a doubt I shall be able to collect a room of pleasing paintings, the average price of which will not exceed £5.00 each" (53).

As noted earlier, Macfarlane possessed a distinctive artistic talent and was certainly not lacking in taste himself, even if he was cynical about it in others (54).

One of the upper rooms of the new museum was to contain the collection of statuary and plaster casts, which had been displayed elsewhere in Bridge of Allan since 1843. Unlike the paintings which he was still collecting, Macfarlane does not seem to have been routinely adding to this collection. However in 1862 he bought, in Scotland, a named piece, a Bacchus and Ariadne by Contarini (?), formerly in Dresden, "a splendid Group of Marble Statuary for my intended new building, the upper room of which will be fitted up in the same style as that in which I have deposited my paintings" (55). As a result of such additions, the museum's name was suitably modified to the 'Macfarlane Museum of Natural History and Gallery of Casts and Paintings'.

The Wave Peaks

Part of the trouble that Macfarlane had with Stevens was his insistence on only purchasing cheap items. This was partly because in the lots containing more than one item, such as cases of birds or insects, there were often duplicates. After a while, however, he realized that to obtain centre-pieces, or items which were rare or missing from his collection, he would have to be prepared to pay a higher price. He wrote to Brown:

> "I have no doubt about what you state, about Stevens picking up for himself anything which is most uncommon or rare for many articles coming under that head which I have ordered him to purchase for me I never got" (56).

He continued to be cost-conscious, but grew more selective as the collection filled out. He also began disposing of surplus items. In January 1862 he wrote to Brown about a forthcoming Stevens sale:

> "John Murray has gone over it [the catalogue] and he finds in it very few skins of which we have not got the specimens of. Several of the numbers which you have...recommended me to purchase are part of my own stock.... I am glad you have secured the stork for my museum" (57).

On 25th January he wrote to Stevens in the same vein: "I have duplicates of nearly all the birds contained in your Catalogue of sale on Tuesday next", contenting himself with a very modest order of only three lots, including a "Spotted Eagle", if to be had at "moderate prices".

His wish for a really spectacular Tiger had finally been achieved, and he delightedly reported its arrival to Brown, who had supervised the stuffing, that "The Tiger arrived this morning. It is a very fine specimen...I suppose for size it must be about one of the largest specimens brought to this country" (58). What was probably his most expensive single purchase, however, was a Giraffe, which had died in a travelling menagerie at Cupar. Macfarlane sent Murray to negotiate, but the owner stuck out for 15 guineas, and got it. Since he had paid only £10 for his other best items, the Lion and the Tiger, Macfarlane felt he had acted against his own better judgement, but Brown's approval, when the skin reached Manchester to be stuffed, helped to reconcile him to the price (59).

By October 1863 Macfarlane was able to report that "the Museum has now grown to a greater extent in the Collection of Specimens, as makes it more of a Public Institution, than a private one" (60), but he had suffered a number of serious

financial reverses during the previous year or so. In the summer of 1862 he found himself short of money, his considerable expenditure on his various projects, plus charitable donations, having led to a cash-flow problem. He wrote to Brown: "I have overdone my funds in the buildings &c I have been erecting lately and for the present I have to suspend the building of the New Museum" (61).

This was a temporary setback, but much worse was, when he himself was recovering from a serious illness in the autumn, he found that Brown had died. He paid generous tribute to his old friend's assistance with the museum. Brown, he said, was the real founder of his museum: "I have no one to supply his place to enable me to carry my...collection to...completion" (62).

There were other difficulties too. As already mentioned, Macfarlane had high expectations about the growing prosperity of Bridge of Allan, and its importance as a tourist resort. He envisaged the museum as a focal point, which together with the library, reading room and art gallery, would provide both an attraction for visitors, and a source of instruction for the working man. As with his earlier projects, he was keen that it should provide education and instruction, as well as amusement, and that this should be available to all.

The dual function was reflected in differential ticket prices, for ordinary visitors, and for working men and school children (63). The former were charged a shilling, the latter only threepence. However, while tourist attendance seems to have increased in line with his expectations, Macfarlane was disappointed by the lack of response from local people. In a letter to Lord Brougham (64), written in 1863, he lamented that, unlike his Free Library in Stirling which "has been well attended...from its Commencement, and during the winter months...is usually crowded in the Evenings with working men", the museum, undertaken "to benefit these Working Classes...has turned out, I am sorry to say, A Complete Failure" (65).

Macfarlane managed to weather these problems. By 1863 he had recommenced building operations, and had obtained a feu of a parcel of land adjoining the museum from the neighbouring estate of Lord Abercromby to permit protecting it from the eastern side. He obtained a promise of help, albeit more restricted than that given by Brown, from a Dr Alcock (66). However, a further and more serious setback was in store for him, nothing less than the desertion, as he probably saw it, of John Murray, on whom rested his hopes for the future day-to-day running of the museum.

From the Macfarlane Museum to the *Challenger*: Murray's role

John Murray was Curator of the Macfarlane Museum but its direction remained firmly in his grandfather's hands. While the creation of the museum was something which interested Macfarlane personally, he also planned it with reference to his young grandson, intending to turn a teenage hobby into the means of providing a permanent occupation and livelihood for the younger man, while at the same time securing the future of his enterprise.

In Macfarlane's letters Murray is always referred to formally, as his curator, a professional colleague. He rarely enters the limelight but is often visible working in the background, except during brief absences abroad or on summer holidays, sometimes overseeing the various building projects connected with the museum. It was he who carried out the detailed work involved in acquiring, arranging, labelling and cataloguing the collections. Macfarlane frequently refers to him in questions about the detail of the holdings, and Murray clearly corresponded on his own account with Brown and others about museum business, although these letters are mostly not entered in the letterbook.

For a time, the arrangement worked out well. In the spring of 1861 Murray travelled to London and Paris to gain first-hand experience of the great national natural history museums. In typically inflated vein, Macfarlane wrote to a local worthy in Bridge of Allan:

> "Mr. Murray, the Curator, has just now returned from visiting the Jardin des Plants, Paris, and the British Museum, London, and makes the following report of my Museum namely that with exception of its size that it will bear a comparison with either of these two Museums, and there are many of my specimens superior to theirs" (67).

One point which emerges is that at this stage Murray was not usually resident in his grandfather's house, but that in the early summer of 1861 he was staying there because his grandfather had hired a young Frenchman to live in and give him language lessons. Macfarlane only once in these letters complains about his grandson; the strain of having two young men in the house was clearly too much for him. He wrote to Brown

> "You are very much mistaken in respect to him or anyone else living with me. I do assure you that he and the young Frenchman interfere very much with my comfort at the present time, and I am making a great sacrifice of

> myself merely to give to John Murray this opportunity of...acquiring a knowledge of the French language" (68).

It should be remembered that Macfarlane at this time was in his late seventies, and had been in poor health on and off for the previous six months. It appears that the problem was not the high spirits of the young men, but the fact that Macfarlane was accustomed to take all his meals in his own room, and having to vacate it to preside at table in a cold dining room was too uncomfortable. After another few weeks of misery he wrote to the young Frenchman: "I find myself wholly unable to endure it any longer, and quite unable to undertake the duties of heading my table at every meal" (69). Finding that the young man had entered into an agreement to take other students, without his permission, Macfarlane abruptly terminated the arrangement half-way through the six-month period initially agreed.

Early in 1861 Macfarlane had slipped on the icy path leading from his house to the museum, and fell heavily on his right shoulder. He complained of deafness, and was in continued poor health throughout the first half of 1861. He then recovered somewhat, or at least makes fewer complaints about his health. When he does refer to it again in the early part of 1862, it is to say that he is "very unwell" (which may be reflected in a three-week gap in the correspondence). In March he asked a friend to stand in for him at the dinner to mark the move of the Free Library to new premises in Stirling. It is difficult to be certain whether there was not an element of reclusiveness in this, but his reference to a serious illness in the late summer of 1862 is also matched by a gap in the letters. The problems associated with ill health and advancing age doubtless precipitated the rift which now emerged between Macfarlane and John Murray.

Murray was no longer the teenager who had arrived from Canada four years earlier. Fond though he was of the area, and the scientific, sporting and other outdoor interests associated with it, he was clearly beginning to look beyond the rather restricted career his grandfather had mapped out for him. The museum, though its contents were organized on scientific lines, was far from being a scientific institution, and apart from Brown, its links with professionals were minimal (70). Not surprisingly, Murray felt the need of more formal training and wider contact with the outside world of learning. In May 1863 he registered as a student in the summer session at Edinburgh University. He registered again in the autumn of 1864, but then does not appear again on student lists until after his grandfather's death in 1868. We know from family tradition, reported by Boog Watson (1967), however, that Macfarlane consented to allow Murray to go to university if he studied medicine, but that he disliked the course and abandoned it after a few weeks (71).

Their growing disagreement presumably lay behind Macfarlane's will of July 1865, which laid down stringent conditions for Murray's continued employment as curator of the museum after Macfarlane's death (72). Virtually all Macfarlane's property was to be left in trust for the museum, with a board of trustees to administer it, applying the funds from his estate. John Murray was appointed curator for life, with a salary to be paid quarterly. He was to be allowed no freedom of action: even his hours were laid down, and part of the bequest was conditional on his changing his name, though this was later revoked. A quieter personality might have been content with this arrangement, or a less determined one might have accepted it, but Murray was neither of these things, in fact in many ways he resembled his grandfather. The two of them shared both entrepreneurial spirit and drive. It seems that their differences were patched up for a while, but in the summer of 1867 the disagreement came to a head.

In a codicil dated in the autumn of that year Macfarlane cancelled all provision for Murray in his will, giving as the reason that Murray had told him that he could do better for himself than accept the provision which his grandfather intended to leave him (73). In the following spring, Murray shipped as surgeon on a Dundee whaler, the *Jan Mayen* of Peterhead, on the strength of the few medical lectures he had attended. They were away from late February to the end of August (reaching 81° N). Murray kept the ship's meteorological log book (74), in which he also recorded sightings of birds and mammals, and creatures caught by tow-netting. The *Jan Mayen* also made at least one deep sounding - 160 fathoms in 72° N, 18° W - and Murray recorded surface temperature, bottom temperature and kept and analysed the blue mud bottom sample. This was about three weeks before the *Lightning,* with Wyville Thomson, future scientific leader of the *Challenger* expedition, and W.B. Carpenter on board, carried out the historic dredgings in the deep water of the Faroe-Shetland Channel which proved that life was to be found even at great depths in the sea (Deacon, 1997). Murray's log ends on 28th August 1868; his grandfather died the same day.

Murray was now his own master, although not a wealthy man. He was able to pursue his own informal studies at Edinburgh University, working in P.G. Tait's physical laboratory (Knott, 1911) where he earned the nickname of the 'chronic student' from Robert Louis Stevenson (Boog Watson, 1967) (75). Here, among other things, he worked on thermo-electricity and conductivity and constructed an experimental electric deep-sea thermometer (76). He still spent weekends and vacations with his great-aunt (Macfarlane's sister) at Bridge of Allan, and with Laurence Pullar, one of the Macfarlane trustees, and other young friends made holiday trips, dredging in the Firth of Forth and yachting in the Western Isles. Pullar (1910) relates how on one of these trips a chance meeting with Sir William

Thomson, Lord Kelvin, was another link in the chain of events that resulted in Murray's selection for the *Challenger*, by Tait's friend and colleague, Wyville Thomson.

So we have come full circle, and can now appreciate Murray's unique if unorthodox qualifications for his appointment. Though without formal biological training, his work for the museum had made him familiar with the broad outlines of the animal kingdom, and the workings of systematics. He was a competent field naturalist, and like so many of the great names in the history of marine science in the 19th century had familiarized himself with the study of marine organisms through dredging in the Firth of Forth, as well as further afield. He was an experienced seafarer, not only in the handling of small boats, but also having taken a six-month Arctic voyage in his stride, and he had worked under one of the leading physicists of the age. He was ideally suited to complement the other two younger naturalists in the team, the academically brilliant high-flyers Moseley and Willemoes-Suhm, and in the end more physically able to withstand the rigours of the long voyage. In the log kept on the *Jan Mayen,* we already see him working in the same areas which he was so successfully to make his own on the later voyage.

But there are even closer resemblances to be observed between this defining period in his adult career and the apprenticeship years at Bridge of Allan and Edinburgh. From Murray's own words we know the powerful impact of the Scottish scenery upon his youthful imagination, and how it aroused in him the desire to explore and understand the differing forces which had shaped its features. However the science of geology on land was perhaps by this time too well organized to engage his undivided attention. In his *Challenger* work on the ocean floor, he was involved in pioneering studies of a major portion of the earth's surface to which scientists had had virtually no access previously. When the *Challenger* set sail, only the topography of the North Atlantic and Mediterranean were known even in outline, largely through the naval surveys made as a prelude to submarine cable laying, while of the sediments which cover the ocean floor only one, *globigerina* ooze, occurring at medium depths, had been closely examined, and experts disagreed about how it was formed.

Charting the ocean basins has been a cumulative process which is not complete even today, nearly eighty years after the introduction of echo-sounding. At the time of the *Challenger*, and for many years afterwards, knowledge of ocean depths was still patiently acquired by sounding with apparatus based on the seaman's lead and line. Even so, by the time Murray published the *Challenger Report* on deep-sea sediments in 1891, he was able, with the assistance of the Belgian geochemist Alphonse Renard, to produce a world-wide chart showing the principal sediment

types found on the deep ocean floor, and to give an account of their origin and distribution. In carrying out this work, Murray was applying, in a wider context, interests developed as part of his early experiences, "washing the clays of the carse for minute organisms" (A.W.D., 1899: 8) and dredging and tow-netting in Scottish waters. By such means he developed a new specialization, apparently himself identifying an area of work little stressed in the planning of the expedition, but which more recently has begun to yield invaluable evidence about the past history of the earth and oceans.

During his time at the museum, Murray had acquired a broad though not necessarily deep knowledge of the animal kingdom, and had learnt how to manage a large and somewhat heterogeneous collection, both in terms of its scientific arrangement and in its general handling. This, too, in many respects prefigures his work in the *Challenger*. Here the strength of his role as naturalist was as an all-rounder, and this must have been the thinking behind his selection, to complement the specialized zoological skills of the others. The expedition collected mainly marine life from deep water, but it also took birds and other animals from little-known islands (see Plate 4) or other remote places visited during the voyage. Someone was needed to undertake this more general side of the work, who, while the zoologists did the more detailed work of identifying marine specimens, would also supervise the enormous task of preparing, preserving, labelling and packing the individual items for carriage home.

When they returned, Murray again found himself closely linked as principal helper to a more senior figure, when Wyville Thomson, returning to his professorial duties at Edinburgh, appointed him his assistant at the Challenger Office. Here Murray was responsible for sorting the collections and distributing specimens to the various experts who were to report upon them, but when Thomson fell ill, and later died, Murray gradually took over direction of the project and the editing of the report and put his own stamp upon it. It is certain that without his perseverance the task would never have been completed in full. As a young man, he had felt obliged to move on from his grandfather's museum. In maturity, he amply showed that he had the resolution and staying power needed to bring a large and complex project to fruition, and by this one act alone ensured his enduring scientific reputation.

In some sources it is said that Murray was chosen for the *Challenger* at the last minute, to replace someone else who had dropped out, but this is misleading. His name was among those submitted to the Royal Society Circumnavigation Committee during the summer of 1872, and it was another of these, William Stirling, a young physiologist who subsequently held professorships at Aberdeen

Plate 4

Party Skinning Penguins

Inaccessible Island, Tristan da Cunha

This photograph of a landing party from H.M.S. *Challenger*, in 1873, shows John Murray seated on the right (wearing a Tam o' Shanter)

(Photograph by permission of the Trustees of the Natural History Museum, London)

and Manchester, who withdrew, and was replaced by the young German scientist Rudolf von Willemoes-Suhm. We find the incorrect version in the chapter on Murray in W.A. Herdman's *Founders of Oceanography,* in 1923, and in the lecture on which it was based (Herdman, 1917), but it also occurs earlier, in an article by A.E. Shipley in 1914. Murray was an addition only insofar as Wyville Thomson had originally asked for two rather than three naturalists.

But what of the Macfarlane Museum? It continued to be a local attraction. Earl Russell and his family were said to have visited it shortly before Macfarlane's death in 1868 (77), and it was generally felt to be a remarkable institution, even for so fashionable a place. Murray himself became a trustee of his grandfather's museum, as did Laurence Pullar, and took pains to maintain it.

However, when Macfarlane died his affairs were in confusion (Pullar, 1910) and the long-term financial support he had planned for the museum was not forthcoming. Furthermore, the new building of which he had been so proud was increasingly felt to be both ugly and unsuitable. A local fund-raising campaign was organized, culminating with a Grand Fancy Bazaar in Stirling in April 1886. With the proceeds, a public hall was built at Bridge of Allan (see Plate 3) with space to accommodate the museum exhibits. This replacement building is currently derelict and threatened by redevelopment, but the museum it once contained has long since disappeared, possibly as soon as the early 1900s (78).

Some of the exhibits may have found a home at the Smith Institute, founded in Stirling by Thomas Smith of Glassingall in 1874, which still survives. By 1887 this Institute strongly resembled the Macfarlane Museum complex at Coney Hill, comprising a museum of science and art, library, reading room and picture gallery. In fact, the library it contained at this period was none other than John Macfarlane's former Free Library (13), probably with the contents of the small museum attached to it. Whether other items came from Bridge of Allan is hard to establish, since early acquisition records are incomplete.

So in the absence of any positively identified survivors from its contents, what should posterity's verdict be on the Macfarlane Museum? Was it just an old man's folly, or a more serious enterprise? There were clearly elements of the former, and Macfarlane's claims for the museum were often inflated, since he was a tireless publicist. However, though in the absence of a printed catalogue there are only some partial handwritten lists (79), plus the record of John Macfarlane's correspondence when he was building up the collection, to rely on in establishing a picture of the contents, there is enough evidence to show that if circumstances had been different the museum might well have survived, if not as a major national

institution, as a valuable local amenity. While some doubt over this must be suggested by the probable poor quality of the pictures which Macfarlane so candidly admitted were second-rate, such reservations may not be necessary with regard to the natural history exhibition which formed the central feature of the museum. Macfarlane's artist's eye clearly valued well-presented and natural-looking exhibits. With Brown also advising and regularly visiting the museum, it is probably fair to assume that the exhibits were reasonably professional. Though Macfarlane tried to keep costs down, he had come to accept paying more for exceptional exhibits. The loss of Brown was a severe blow, but enough had probably been done by then to launch the museum satisfactorily, had it not been for errors of judgement by Macfarlane. He may have had the misfortune to die when his financial affairs were temporarily upset, possibly as a result of some generous donation to yet another good cause, or perhaps because, after all, his plans for the museum had been too ambitious, but he could not have foreseen that Bridge of Allan would not continue to expand as he had hoped, since spas went out of fashion and tourism became less important in the local economy. Murray in later years, as one of the trustees, did much towards re-establishing his grandfather's foundations in conditions more appropriate to changing times and circumstances. Science gained from it, but perhaps Macfarlane's greatest mistake was to alienate his grandson.

There are many resemblances between the characters of Murray and his grandfather, but Murray, though he could be combative, was a less embattled personality. It was not that John Macfarlane did not have kindly instincts, since we even find him worrying that his tenants in a newly-built house might catch cold, but the need to control events seems to have caused some havoc in both his private and public life. Murray was the greater man; in spite of a dominating and certainly sometimes domineering character, he could appreciate that there might be different points of view. When informed that his sons did not want to become oceanographers, as he had hoped they would, he did not seek to cut them off without a shilling, but made equitable provision for both his family and his scientific inheritance. During his life he was a great benefactor of science, and through the funds he bequeathed, as well as through his own contribution and his impact on others, his influence on 20th century marine science has been enormous. The career of such a commanding figure deserves more attention and analysis than it has so far received.

Acknowledgements

Among the many people and institutions who have helped in this research I should particularly like to thank Mrs Eileen Brunton, formerly on the staff of the

Natural History Museum, who discovered the Macfarlane Museum letterbook and told me about it, and Mr. J. Malcolm Allan of Bridge of Allan for so kindly sharing his own knowledge of Murray and Macfarlane, and especially for showing me the original site of the Macfarlane Museum. I am grateful to the Trustees of the Natural History Museum, London, for kindly allowing me to reproduce passages from the Macfarlane letterbook, and to University College London for permission to quote from Macfarlane's letter to Lord Brougham. Last but not least, I owe a particular debt of gratitude to the Scripps Institution of Oceanography, University of California, San Diego, U.S.A., for assisting this research through the award of the 1997 Ritter Fellowship.

Notes

1. Natural History Museum London, Murray collection. Macfarlane Letterbook No. 2 (henceforward referred to as NHM Letterbook); from John Macfarlane (JMF) to Thomas Brown (TB), 8th November 1860. In transcribing the letters the sometimes idiosyncratic spelling has been left largely unaltered, but punctuation has been added as the item demands it.

2. Since the Natural History Museum's letterbook is numbered 2, there must have been an earlier one in the series, and perhaps one or more successors, covering the period from 1863 to 1868, when John Macfarlane died. It contains copies of John Macfarlane's business letters, covering all his projects, but mainly museum affairs, of which he wished to keep a record, so did not include all his correspondence. A large proportion of the copies are in John Murray's hand, and the general level of presentation becomes more assured as he matured over the two and a half years (November 1860 to April 1863) represented in the book.

3. NHM Letterbook, JMF to TB, 4th November 1861.

4. One reason for this is that though Murray's scientific papers are at the Natural History Museum in London, his correspondence has mostly not survived.

5. Address printed in the *Spa Magazine*, June 1899, No. 9, pp. 11-17 (p.11). It is also in Graham (1900), pp. 171-190. In this speech, Murray gives his age on his first crossing of the Atlantic to his new home in Scotland as 15, but in a biographical article published in the previous number of the *Spa Magazine* (A.W.D., 1899: p. 4) 1857 (age 16) is given as the year of his arrival. Another article prepared under his supervision at about the same time for the Biographical Press Agency (see Note 21) states that it was in 1858, when he was 17, that he came to Scotland. I have adopted this latter date, which is the one found in most biographical notices. Student records of Victoria College, Ontario, show that he was registered there for the academic year of 1856-57.

6. What follows is only a sketch of the life of John Macfarlane. The letterbook in the Natural History Museum contains many details of his numerous other interests in the 1860s, which are only briefly noted here. I am very grateful to Mr. J. Malcolm Allan, of Bridge of Allan, for generously sharing his local and other information about Macfarlane, and about Murray's years at Bridge of Allan.

7. Obituary of John Macfarlane, *Stirling Journal and Advertiser*, 4th September 1868.

8. Sir James Edward Alexander (1803-1885), a professional soldier, inherited Westerton from his brother, Major John Henderson (1806-1858) (who had changed his name on coming into the property) on the latter's death. His principal claim to fame today is as the person responsible for the erection of Cleopatra's Needle on the Thames embankment in London.

9. I am grateful to Mr. J. Malcolm Allan for suplying information about Macfarlane's Manchester years.

10. Macfarlane's obituary (see note 7) states that "At a comparatively early period of his life he evinced a taste for devising new designs for manufactured fabrics" and that these were commercially successful.

11. NHM Letterbook, JMF to James Morison, 5th March 1861.

12. NHM Letterbook, JMF to James Morison, 5th March 1861. Macfarlane later maintained that it was Stirling's failure to take up the opportunity that decided him against locating his museum there.

13. The Free Library was set up in response to legislation on early closing (shops) (Drysdale, 1898). It later merged with the Smith Institute, but was transferred by the Macfarlane trustees to the Stirling Public Library c. 1902 (Stirling Public Library: *Catalogue of Books in the Lending Department*, 1904). Macfarlane felt that this had been a great success in helping ordinary people to get on, through providing an alternative to "Ale Houses and Rum Shops" (see Note 14).

14. According to a letter Macfarlane wrote to Lord Brougham, this was to encourage people to donate relics from Stirling Castle which had been "barbarously dispersed" by the government when converting the castle into barracks (University College London, Brougham Papers, MS 5375, Macfarlane to Brougham, 1st October 1863). It also contained other local antiquities.

15. NHM Letterbook, JMF to Dr. Rodgers and Ebenezer Morison, [20/21] May 1861. Macfarlane says that he first suggested the idea over 20 years ago, but Charles Rogers, a local clergyman and antiquarian, has usually been regarded as the originator of the scheme, based on the claim made in his book, *A Week at Bridge of Allan* (1856). A more recent source (MacLean, 1970) suggests that

the prime mover was Sir James Alexander. The foundation stone of the Wallace Monument on Abbey Craig was laid by the Duke of Atholl on 24th June 1869 (Nimmo, 1880; vol. 2, pp. 371-372)). The monument cost £14.000, which was raised with difficulty. John Macfarlane was the principal subscriber.

16. As Note 15. Macfarlane wanted a simple column and statue, and asked for his money back when the design based on a baronial tower was accepted. He wrote:

    > that if the monument to be erected would be other than a Column I should regret having been a subscriber. For I had previously travelled over parts of England, Scotland, Ireland, parts of France, the Netherlands, and Holland and took observation of the various erections I saw on elevated places and of those particularly which I thought would be most suitable to the Abby Craig, and these were uniformly columns.

17. According to Nimmo (1880) the population had expanded from 1,803 in 1861 to 3,065 when Bridge of Allan achieved burgh status ten years later. However that total would have been greatly, if more transiently, increased by visitors to the health resort. The young Robert Louis Stevenson was among their number on more than one occasion during the 1860s and early 1870s.

18. As long as people went along with his wishes, he was capable of great thoughtfulness and kindness; for example, worrying in a letter about the tenants in one of his new houses because it might be damp.

19. John Murray's father is described as an accountant in biographical notices. Family tradition says he was in the post office, a responsible position, but perhaps not grand enough for John Macfarlane, since family tradition also says that he disapproved of the marriage.

20. Victoria College is now part of Toronto University, but the original building still stands in Coburg. It was founded to provide higher education for nonconformists who were barred from Anglican universities until the late nineteenth century.

21. Quoted in an article in the local *Spa Magazine* (A.W.D., 1899: p. 8). A biographical article written in 1903 by James Chumley, Murray's secretary, under Murray's direction, for the Biographical Press Agency, states that Murray's own collections also formed part of the Museum. (Corrected proof held in University of Edinburgh Library, Special Collections, Challenger Papers).

22. In Murray's address at Stirling High School's annual concert, 30th March 1899 (Murray, 1899; also in Graham, 1900), he said that he wished to attend the school because of its high reputation for the teaching of navigation. From the mathematics teacher Duncan McDougal he also learned about electricity and his grandfather allowed him to buy an electric lamp and about 80 Bunsen cells with which, with the aid of a concave mirror, "I now and then illuminated the whole country-side". However, "so many floors, walls, and clothes, so much zinc and

epidermis were destroyed by the nitric acid and...fumes that these experiments were ultimately prohibited". He then purchased a large induction-coil capable of giving violent shocks, so much so that a professor (Tait?) on seeing it said "it was fortunate no person was killed". After some chaotic incidents, "I was requested to turn my attention to the observational sciences of botany, zoology, and geology".

23. Murray, 1899, p. 14.

24. See Notes 1 and 2. Where the museum was actually housed before the new building was ready is not clear. The most likely location must be the hall in the centre of Bridge of Allan where the gallery of casts and paintings was originally housed. Nor is it certain when Macfarlane began planning the museum, or when the collection was first opened to visitors. J. Malcolm Allan (pers. comm.) points out that this must have been after 1856, since a local guide-book published during that year (Farie, 1856) describes the art collection but makes no mention of any natural history objects. Yet clearly by the autumn of 1860 both the collections and the building were at an advanced stage of preparation.

25. University College London, Brougham Papers, MS 5375, Macfarlane to Brougham, 1st October 1863.

26. NHM Letterbook, JMF to Mrs Brown, 13th October 1862.

27. Macfarlane had previously lived in Ivy Lodge, now the Old Manor Hotel, but by 1860 he had moved up the hill to one of his own new houses, Edge Hill House. From here the new museum building was situated just across the little lane which strikes obliquely uphill from the main highway running from Bridge of Allan towards Stirling, not far from the present-day campus of Stirling University. It was pulled down after another home was built for the museum after Macfarlane's death. I am grateful to Mr. J. Malcolm Allan for showing me the exact location of the building and for loaning me a contemporary postcard showing part of Macfarlane's building and the 1880s replacement (see Figure 2).

28. NHM Letterbook, JMF to TB, n.d. [23/24 November 1860].

29. NHM Letterbook, JMF to TB, 28th February 1861. He speaks of employing a boy to do this, but appears to have continued using the Manchester contact.

30. NHM Letterbook, JMF to P.L. Sclater, 9th February 1861.

31. NHM Letterbook, JMF to TB, 25th March 1861. Macfarlane complains:

> The Zoological Gardens in London must be uncommonly healthy for I have had no offer of any of their animals.

The British Museum had first refusal of any creatures which died at the Zoo, but Sclater agreed to let Macfarlane have items not wanted there. However, in a

letter to A.D. Bartlett on 30th December 1861 Macfarlane complained that he had still not been offered anything.

32. NHM Letterbook, JMF to John Anderson, hotelier, 25th March 1861.

33. NHM Letterbook, JMF to TB, 21st December 1860.

34. NHM Letterbook, JMF to TB, 7th January 1861.

35. NHM Letterbook, JMF to TB, 26th January 1861.

36. NHM Letterbook, JMF to TB, 25th February 1861.

37. NHM Letterbook, JMF to J.G. Stevens, 25th February 1861.

38. NHM Letterbook, JMF to J.G. Stevens, 25th March 1861.

39. NHM Letterbook, JMF to J.G. Stevens, 1st April 1861.

40. NHM Letterbook, JMF to TB, 23rd April 1861.

41. NHM Letterbook, JHM to R.G. Gordon-Cumming, 25th June 1861. Roualeyn George Gordon-Cumming (1820-1866) was a former army officer turned big-game hunter, who, Macfarlane had told Brown a month previously (28th May 1861) "has fixed his museum permanently at Fort Augustus". Curiosity about this, rather than any educational advantages to be derived, must almost certainly have been the reason for Macfarlane's sudden decision to send Murray on a grand tour of the Caledonian Canal.

42. NHM Letterbook, JMF to TB, 25th July 1861.

43. NHM Letterbook, JMF to George Street, 19th July 1861.

44. NHM Letterbook, JMF to E.L. Layard, 19th October 1861, but Layard was unable to obtain any Kiwis, since they had grown very scarce in that area.

    No catalogue was ever published which would provide a full idea of the museum's contents, but we know that the number of specimens held in 1863 was over 22,250 (see Note 79).

45. NHM Letterbook, JMF to TB, n.d. [23/24 November 1860].

46. NHM Letterbook, JMF to TB, 21st December 1860.

47. NHM Letterbook, JMF to TB, 24th December 1860.

48. NHM Letterbook, JMF to TB, 15th July 1861.

49. NHM Letterbook, JMF to TB, 4th November 1861.

50. NHM Letterbook, JMF to Messrs James Coubrough and Co., 22nd November 1861.

51. NHM Letterbook, JMF to J.L. Wingate, 16th November 1861.

52. NHM Letterbook, JMF to J.G. Stevens, 9th February 1861.

53. NHM Letterbook, JMF to TB, 12th February 1861.

54. For example, NHM Letterbook, JMF to TB, 1st January 1861, where he thinks Stevens has paid too much for a copy of Bewick, but then adds:
    > His engraved tailpieces alone are worth the money, they are so true to nature and some of them are very funny. Besides I think the positions of the Birds are more natural than in any of the more recent publications.

55. NHM Letterbook, JMF to TB, 25th January 1862.

56. NHM Letterbook, JMF to TB, 21st May 1861.

57. NHM Letterbook, JMF to TB, 7th January 1862.

58. NHM Letterbook, JMF to TB, 23rd November 1861.

59. NHM Letterbook, JMF to TB, 27th April and 6th May 1862.

60. University College London, Brougham Papers, MS 5375, Macfarlane to Brougham, 1st October 1863.

61. NHM Letterbook, JMF to TB, 10th May [June] 1862.

62. NHM Letterbook, JMF to Mrs Brown, 13th October 1862.

63. There is no mention of working women.

64. University College London, Brougham Papers, MS 5375, Macfarlane to Brougham, 1st October 1863. The paper on which the letter is written has a printed heading of a still later expanded version of the museum's title: Macfarlane Museum of Natural History, Library and Reading Room and Gallery of Paintings, Marble Sculpture, and Casts from the Antique; Macfarlane Terrace, Coney Hill, Bridge of Allan East (see Plate 2).

65. (See Note 64). Although Macfarlane was being somewhat selective in this claim, there is no doubting the sincerity of his wish that the museum should benefit the disadvantaged in society. Characteristically, he blamed the lower orders for not making better use of it, commenting that since food is cheap, and labour better paid: "If they do not rise as a Class, the fault will be their own".

66. NHM Letterbook, JMF to Alcock, 15th December 1862. This was probably Dr. Thomas Alcock, M.D. (1823-91), author of a number of works on zoology and natural history.

67. NHM Letterbook, JMF to John Anderson, hotelier in Bridge of Allan, 15th April 1861. He also adds that his birds are better stuffed.

68. NHM Letterbook, JMF to TB, 1st June 1861.

69. NHM Letterbook, JMF to M. Debesque, 23rd July 1861.

70. Macfarlane mentions once or twice that scientific gentlemen have visited the museum; on one occasion it was Professor J.H. Balfour from Edinburgh with a party of students. The only, indirect, contact with the new government-funded museum in Edinburgh is when he suggests that a list of items he is proposing to sell should be shown to Professor Allman, Keeper of Natural History (NHM Letterbook, JMF to Messrs Small & Son, 15th April 1862).

    In 1854 it had been agreed that the University of Edinburgh's Natural History Museum (founded as a teaching collection) should become part of a new government-funded public museum in Edinburgh, but another decade passed before it was moved into the new museum building (opened in 1865 as the Edinburgh Museum of Science and Art) in Chambers Street (Swinney, 1999). Before this, Macfarlane's museum had no really serious competitor.

71. This would almost certainly have been with one of the extra-mural medical courses which competed with the university courses. The most likely time for this would have been the winter of 1867-68, immediately before his Arctic trip, but it could have been a year or two earlier.

72. Scottish Record Office, Registers of Deeds, RD.5 1330 ff. 1-48, trust disposition and settlement, dated 19th July 1865, registered 3rd October 1868.

73. As Note 72; codicil to Macfarlane's will, dated 4th September 1867.

74. Murray's log from the *Jan Mayen* is also in the Murray Collection at the Natural History Museum. It also contains a meteorological log from a previous voyage of the vessel.

75. It has often been remarked that Murray never actually took a degree, but apparently this was not at all unusual. The practice of students signing on with whalers for a bit of adventure was also not uncommon. I am very grateful to Ms. Jo Currie, formerly of the Archives Department at Edinburgh University, for very kindly pointing this out, as for other help in locating Murray's Edinburgh University student registrations.

76. This is recorded in the Biographical Press Agency article (University of Edinburgh Library, Special Collections, Challenger MSS) prepared by Murray in

1903, at the time when he was engaged in the bathymetric survey of Scottish freshwater lochs, in which pioneering work was done with an electrical resistance thermometer.

77. Obituary of John Macfarlane, *Stirling Journal and Advertiser*, 4th September 1868.

78. It is unlikely that the whole of the Macfarlane Museum's collections were in the new building, which also contained a public hall. The difficulty of tracing specimens is made more difficult by the fact that there were two museums, since there was another one in Stirling attached to the Free Library (see Note 14). Some items acquired by the Smith Institute around 1900 may have come from the latter. It is not listed in Murray (1904), and certainly by the 1930s the Macfarlane Museum of Natural History had ceased to exist.

79. There is no indication that a printed catalogue ever existed. Two partial catalogues, of the birds and mammals, survive in the Murray Papers at the Natural History Museum. In his letter to Lord Brougham in 1863 (see Note 64) Macfarlane enclosed a handwritten list by John Murray giving a numerical breakdown of the types of specimens held by the museum. These totalled 22,655, of which Mammals made up 240, Birds 2,200, Reptiles 100, Fishes 50, Skeletons 65, Insects 6,000, Shells 12,000, Corals, Sponges etc. 200, Fossils 800, and Minerals 1,000.

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ON THE ROCKS IN THE SOUTHERN AND ATLANTIC OCEANS - CHANGING GEOLOGICAL PERSPECTIVES

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Introduction

We have come to understand a great deal about the processes which affect the Earth's crust. Geological and geophysical studies in the ocean basins, margins and ocean islands have been crucial in building up the picture of planetary evolution, and in accounting for the contrasting nature of continental and ocean crust. Studies of ocean-floor topography, deep ocean-floor sediments, rocks from the oceanic ridges, and in particular the nature of ocean-island rocks, have been crucial in the developing of such understanding.

This level of understanding has been built upon the pioneering, often heroic efforts of previous generations of earth scientists. Geologists need to walk the outcrops in order to study relationships between various rock types; the geologist at sea is often frustrated with the difficulties of obtaining samples, by the need to make hazardous landings, or by the need to collect rocks underwater by diving, dredging, use of submersibles or drilling. For many years ocean islands provided the only insight into the nature of the ocean basins, which make up 80% of our planet's surface. For this reason, these islands have a geological importance vastly out of proportion to their size and have, over the years, presented particular challenges because of their often remote locations and hostile environments.

The world has become a much smaller place than ever before, and few places are inaccessible nowadays. With appropriate levels of funding it is now possible to visit and study virtually any place on Earth with comparative ease. It is becoming increasingly difficult to appreciate the difficulties faced by pioneering scientists. Rock samples in museum collections furnish an important link with the past, and serve to remind us of former scientific expeditions and the reasons for which they were undertaken. The historically important geological samples in the University

of Glasgow's collections can be used to build up a picture of how our current knowledge has developed over the years.

Later in the paper we will develop the significance of some of the collections in contributing to an evolving understanding of how the oceans developed through time, using examples selected from the contrasted world of:

(i) continental drift and plate tectonics
(ii) exploration for hydrocarbons

There are ample lessons demonstrating how long it took before the full significance of particular occurrences became apparent, and the thrust of our discussion provides a sharp reminder of the folly of short-termism.

In the course of assembling this paper the authors have amassed a substantial bibliography, only part of which can be referred to here, but please contact the senior author if more specific information is required.

By way of introduction, the following works are recommended: Fogg (1992) on the Antarctic, well written and easy to read; Adie (1964), with excellent fossil illustrations; Baker (1973), with tabulated data on the islands of the South Atlantic, updated by LeMasurier and Thomson (1990), with plate-tectonic setting and geochemical data on the volcanoes; and Headland (1989), with his chronological list of Antarctic expeditions.

THE HUNTERIAN MUSEUM GEOLOGICAL COLLECTIONS

The senior author has had the privilege of being able to work with the rock collections in the Hunterian Museum of the University of Glasgow. Opening the drawers in the museum store, and reading names, dates and places from which samples have been collected, reveals a rich and important collection of rocks from the Atlantic and Southern Oceans (Tables 1 and 2, and Figures 1 and 2). This collection has developed from work undertaken by University of Glasgow staff or their associates.

Three Glasgow names in particular spring out from the pages of the scientific history of the sea - Lord Kelvin, John Walter Gregory and George Walter Tyrrell. Although keenly interested in geological matters, Kelvin's association with the sea is better illustrated by the various instruments developed to measure ocean depth, tides or current direction, and in his support for major Antarctic expeditions.

Gregory, the first Professor of Geology at Glasgow, and the Royal Society's first choice as scientific leader of the British National Antarctic Expedition (1901-04), had a more direct interest in geological samples from remote ocean islands. Tyrrell, a petrologist of significance and, like Gregory, of world renown, described the rocks from many remote locations which had been sent to him or which he had collected himself. It is noteworthy that rocks predominate, to the virtual exclusion of fossils. This is partly a reflection of Nature, but almost certainly a function also of Tyrrell's pre-eminent status as Britain's leading petrologist. His magnum opus in the *Discovery II* report series (1945) was based on a total of 372 Hunterian rock specimens and 378 thin sections from twelve islands.

The Hunterian Museum is particularly well endowed with rock specimens from the South Shetland Islands, South Georgia, Iceland, Jan Mayen and Spitsbergen (1,356 out of a total of 1,851) and is excellently supplemented with 1,269 thin sections. We intend to deal with the Spitsbergen collection on a later occasion. In this paper it will be the rarer specimens, often obtained under adverse conditions, which will soon excite our attention as we take a chronological perusal of the collections.

Iceland: Mackenzie 1810

Following the voyages of discovery of Banks in 1772 and Stanley in 1796, Sir George Stuart Mackenzie led an expedition to Iceland in 1810. Some fifteen years after the publication of Hutton's *Theory of the Earth* (1795), evidence from Mackenzie's expedition, particularly the volcanic nature of the island and the obsidian flows with pumice from Domadalshraun, helped to reinforce Hutton's view of crustal processes and render Werner's theories untenable (Mackenzie, 1812; Peacock, 1922a). Mackenzie's Icelandic collection, some 200 samples in all, was rescued from neglect by the Royal Society of Edinburgh and transferred to the Hunterian in 1910 (Peacock, 1922b). The samples were subsequently described in detail by Tyrrell and Peacock (1924) who made a further large Icelandic collection, also preserved in the Hunterian. Mackenzie developed a political interest in Iceland and perhaps his expedition also illustrates colonial aspirations, the motivation for other expeditions with geological outcomes.

Ascension Island: Darwin 1832

Before the advent of submarine studies, ocean islands supplied the only clues to the constitution of the oceanic areas. Darwin made geological observations on various volcanic islands during the voyage of the *Beagle,* visiting St. Jago, Cape Verde Isands, St. Paul's Rocks, Fernando de Noronha, St. Helena and Ascension

Hunterian Museum Rock Collections from Antarctica and the Southern Ocean

Table 1

Locality/Island Group	Rock Specimens	Thin Sections
Adelie Land	3	0
Bouvet Island	5	5
Clarence Island	36	36
Crozet Island	19	20
Elephant Island	26	15
Falkland Islands	16	1
Gibbs Island	15	15
Gough Island	17	17
Graham Land	50	50
Heard & Kerguelen Islands	35	38
McMurdo Sound	1	1
South Sandwich Islands	56	54
South Georgia & Shag Rocks	205	18
South Orkney Islands	13	11
South Shetland Islands	411	410
South Victoria Land	28	3

Figure 1

Geographical Locations

1000 km
SOUTH AMERICA
Falkland Is.
SCOTIA ARC
South Shetlands
Elephant I.
Clarence I.
Graham Land
Gibbs I.
South Orkney Is.
South Georgia
Shag Rocks
South Sandwich Is.
WEDDELL SEA
ANDEAN PROVINCE (Adie)
ROSS SEA
South Pole
ANTARCTICA
Victoria Land
Adélie Land
GONDWANA PROVINCE (Adie)
Bouvet I.
Tristan da Cunha
Gough Is.
AFRICA
Heard Is.
Kerguelen
Crozet Is.
INDIAN OCEAN RIDGE
SOUTHWEST INDIAN RIDGE
INDIAN OCEAN
POLAR PROJ

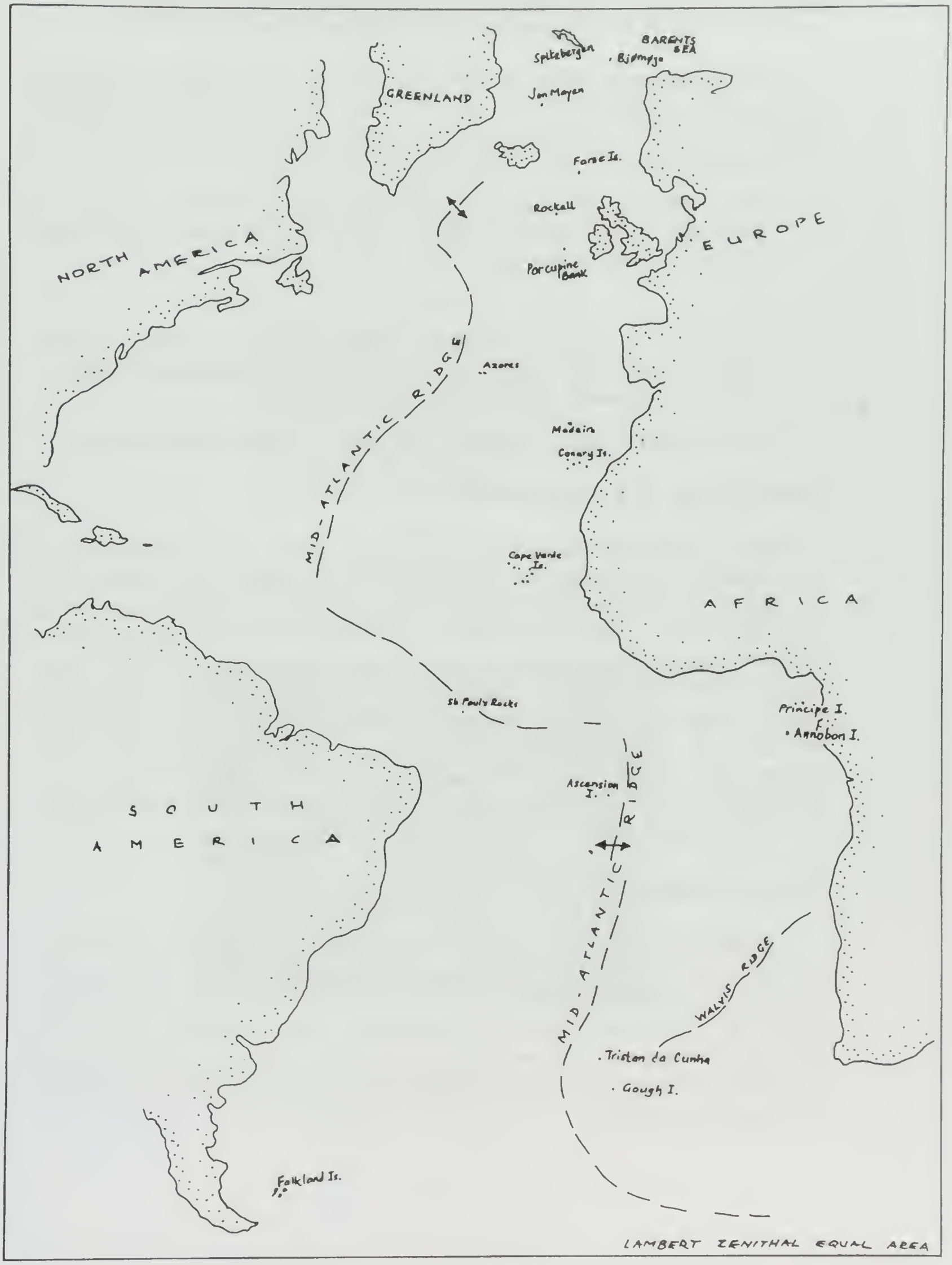
Hunterian Museum Rock Collections from the Atlantic Ocean

Table 2

Locality/Island Group	Rock Specimens	Thin Sections
Annobon Island	13	13
Ascension Island	24	0
Azores	3	1
Canary Islands	58	4
Cape Verde Islands	3	3
Faroe Islands	2	0
Iceland	200	0
Jan Mayen	314	66
Madeira	3	116
Porcupine Bank	12	3
Principe Island	2	2
Rockall	3	4
Spitsbergen	257	174
St Paul's Rocks	11	0

Figure 2

Geographical Locations


BARENTS SEA
Spitsbergen
Bjørnøya
GREENLAND
Jan Mayen
Faroe Is.
Rockall
NORTH AMERICA
EUROPE
Porcupine Bank
MID-ATLANTIC RIDGE
Azores
Madeira
Canary Is.
Cape Verde Is.
AFRICA
St Pauls Rocks
Principe I.
Annobon I.
Ascension I.
SOUTH AMERICA
MID-ATLANTIC RIDGE
WALVIS RIDGE
Tristan da Cunha
Gough I.
Falkland Is.
LAMBERT ZENITHAL EQUAL AREA

Island. He discovered "the delights of geology" on the Atlantic Ocean islands and went on to suggest subsidence of volcanic islands as a cause of coral atolls.

The first systematic studies of ocean islands were those of Daly on Ascension (1925) and St. Helena (1927). Prior to that time, knowledge grew in a piecemeal fashion as expeditions visited the various islands on their way south or north. It was recognised that:

> "The islands of the deep oceans have geological importance out of all proportion to their individual areas or total area, when compared with equal areas of the continents" (Daly, 1925: 4).
>
> and,
>
> "Small as it is, a deep-sea island tells us practically all we shall ever directly ascertain concerning the nature of the solid suboceanic material throughout a much more extensive region" (Daly, 1925: 4).

This last quotation was perhaps one prediction Daly would probably regret.

South Georgia: R.W. Chappell 1871

Three rock samples collected on South Georgia in 1871 were presented to staff at the University of Glasgow early this century. The samples were collected during the voyage of one of the sealing vessels that worked in the Southern Oceans in the nineteenth century, possibly the *Trinity* which was on South Georgia during the 1870-71 summer, captained by Erasmus Darwin Rogers (R.K. Headland, pers. comm.). R.W. Chappell was a junior partner in the sealing firm of Williams and Haven, and in 1872 was involved with the American preparations for an expedition to Heard and Crozet Islands to observe a transit of Venus (Bertrand, 1971). Exactly who collected the rock samples on South Georgia remains to be established, but Chappell presented them to Sheffield University and subsequently the curator presented them to Gregory or Tyrrell in Glasgow.

H.M.S. *Challenger* 1872-76

The *Challenger* collected rocks from ocean islands including St. Paul's Rocks, in addition to sampling deep-sea sediments systematically for the first time. Dredging in the iceberg region yielded rocks similar to those found on continents rather than on oceanic islands. In the thirty-year period following this, at least thirty vessels were collecting deep-sea sediments in the Atlantic, but the quality of the original illustrations has seldom equalled those from the *Challenger* Expedition (see Figures 3a and 3b).

Illustrations of Deep-Sea Sediments from the *Challenger* Expedition
(Murray, 1894a)

Figure 3a

Diatom Ooze
dredged from 1,950 fathoms in the Southern Ocean
(magnified 375 diameters)

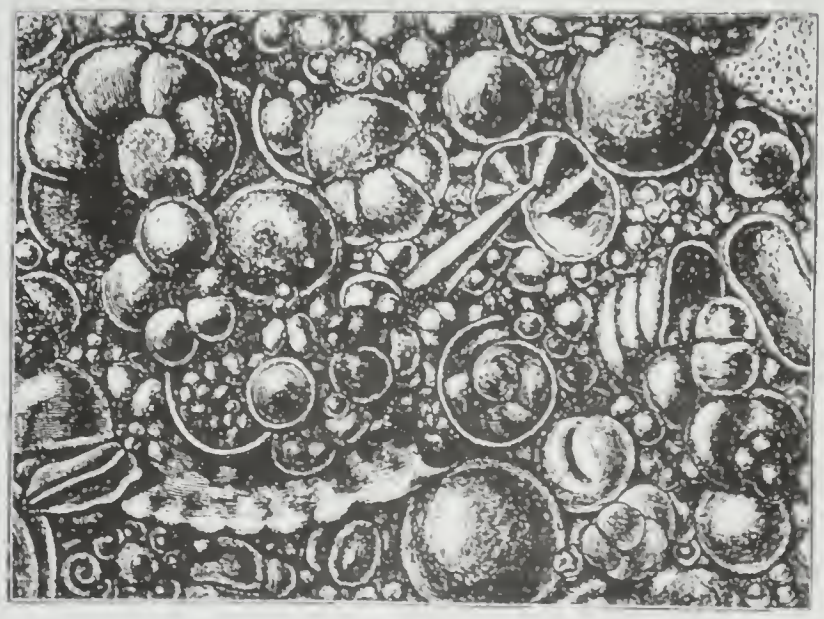


Figure 3b

***Globigerina* Ooze**
dredged from 1,900 fathoms in the Atlantic Ocean
(magnified 25 diameters)

Mount Erebus, South Victoria Land: British Antarctic Expedition 1907-09 First Shackleton [*Nimrod*] Expedition

One of the highlights of Shackleton's *Nimrod* expedition was the ascent of Mount Erebus by a six-man team under Professor Edgeworth David, accompanied by Douglas Mawson. The party took a week to get to the 12,000 feet cone, where they were choked by sulphur fumes and saw a column of steam shoot hundreds of feet into the sky. The *Nimrod* returned to Britain in 1909 with some 250 lbs of rock specimens. Samples of felsite and diorite were donated to Gregory by Professor Edgeworth David and samples of kenyte lava, basalt and andesite also found their way to Tyrrell.

The kenyte sample (Plate 1) is accompanied by a covering letter (Figure 4). The rather florid date on Murray's letter to Dykes understandably led to the kenyte specimen initially being labelled 1889 by Dr. W.D.I. Rolfe, and misled the senior author into investigating a possible earlier expedition! However, the date in question is actually 20/9/09. The specimen was subsequently purchased from Dykes in 1918.

Cape Royds, McMurdo Sound: Priestley 1911
Second Scott [*Terra Nova*] Expedition

One sample of quartz dolerite from Priestley. Priestley was one of the 'northern party' exploring King Edward Island in May 1911 on Scott's second and fatal expedition. In his book *Antarctic Adventure* he wrote:

> "We found the ground littered with erratics and their significance is greater than might be thought for they tell us as plainly as if we saw the ice, that in some former time a great glacier many thousands of feet in thickness must have swept down from the interior of the continent bearing on its surface huge boulders of granite and other rocks from the great mountain range" (Priestley, 1914).

The 35 lb of rock which Scott's party carried to the end, now in the Natural History Museum, London, are the most celebrated of all Antarctic rocks and contain the first *Glossopteris* fauna from Antarctica. Fogg (1992: 252) considers that more ought to have been made of them in the initial continental drift debate. As it was, the final collection of papers (BMNH) did not appear until 1964!

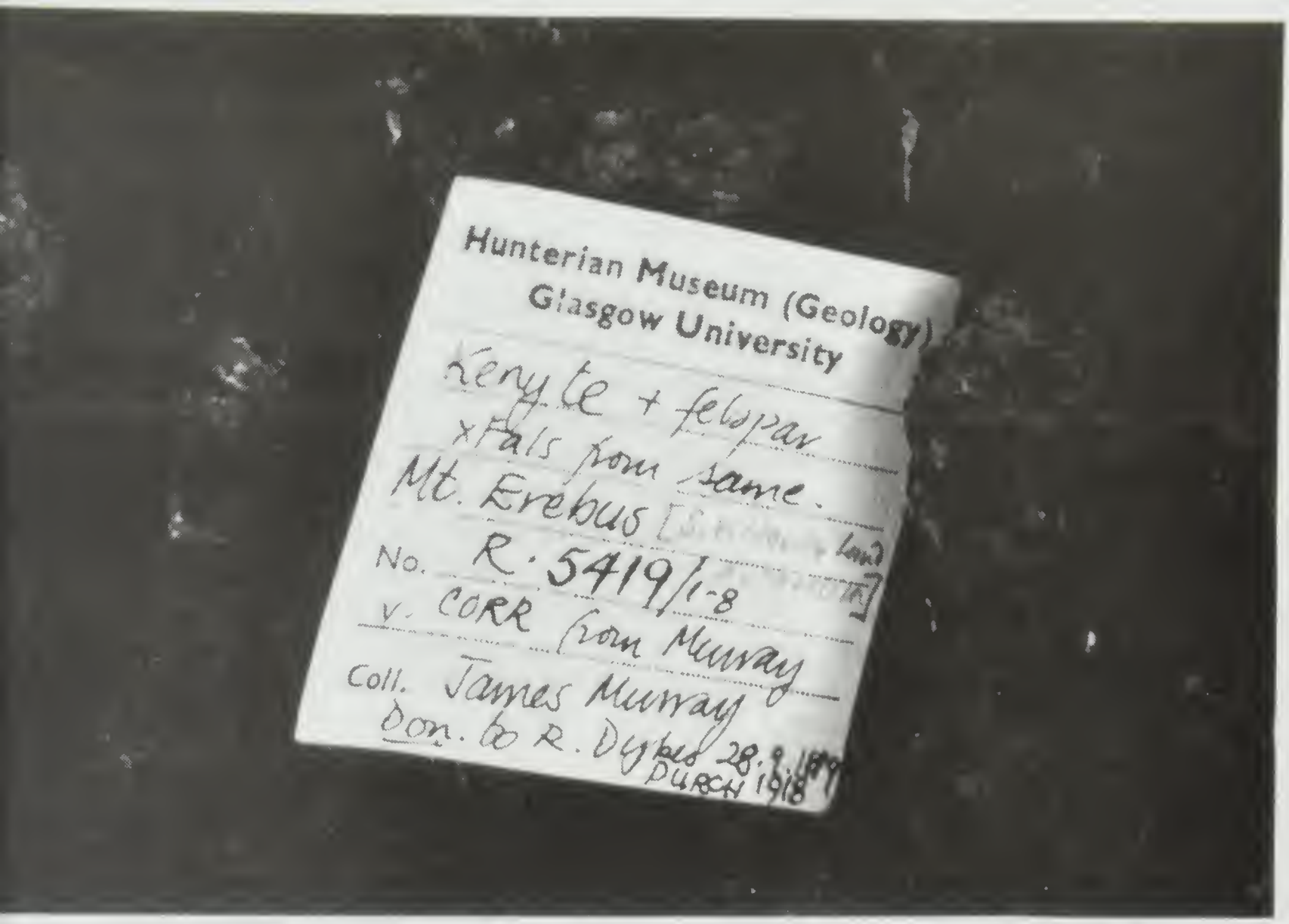


Plate 1

Kenyte sample
R 5419

Note: James Murray was the marine biologist with the Shackleton Nimrod Expedition (1907-09), and a member of the shore party which spent a winter "under the shadow of the mighty Erebus", although he did not accompany the party which made the successful first ascent of the Mount Erebus volcano. The Nimrod Expedition left Antarctica in March 1909. By September of that year the Mount Erebus volcanic rock specimens were on their way to Dykes, about whom little is known at present, and thence to the Hunterian Museum.

INVERMAY,
MAXWELLTOWN,
SCOTLAND.

25/9/89

Dear Dykes.

I am sending you at same time a piece of our native Kemple from Mount Erebus, and 2 pelagic crystals weathered out of the same.

As to photos - I would gladly let you have some, and will, if ever I get my negatives. They have taken jolly good care we don't make bad use of them. All the negatives are confiscated and are held up, for the present, by the publishers. I have hundreds, mostly bad as I am only a beginner, but some are a success. Mine are half plates except the micrographs.

Well, wish you luck & a good job soon.

Yours sincerely
James Murray.

Figure 4

Murray's letter to Dykes
(see page 276)

Commonwealth Bay, Adelie Land: D. Mawson 1911-14
Australian Antarctic Expedition (*via* J.H. Blair)

Rudmose Brown, by then a noted Antarctic historian, praised Mawson publicly for showing that there was more to Antarctic exploration than a race to the South Pole:

> "...it is equally important that we should not neglect the outlying regions of the Antarctic" (Brown, 1923).

It was equally important to the Australian backers than an Australian quadrant of Antarctica be firmly established.

Using the steam yacht *Aurora*, built in Dundee in 1876 and previously used as a Newfoundland sealing vessel, the expedition set out to explore and survey the Antarctic coast between Cape Adare and Gaussberg, a distance of nearly 2,000 miles. The expedition was notable for the discovery of a variety of economic minerals, for the first radio link during an Antarctic expedition, and for tragedy, with the death of two of Mawson's companions, Ninnis and Mertz, one down a crevasse with his dog team and food supplies, and the other as the result of starvation, hardship and vitamin A poisoning from eating dog livers during an epic struggle back to base. Mawson was left to battle on alone through the last 100 miles, and he had to resort to eating boot leather to survive.

South Georgia: D. Ferguson 1911-12
First Salvesen Prospecting Expedition

The Salvesen company directed the extensive whaling industry in South Shetlands, South Georgia and the Falklands, but they were also the lessees of the minerals and mining rights on all of the islands owned by H.M. George V in the South Atlantic outside the Falklands. South Georgia was of particular interest because, as Ferguson (1915) wrote:

> "...a volcanic origin might reasonably be expected for a small island rising out of the Atlantic and remote from any other land area".

However, early geological observations made by Nordenskjold, Fricker and Heim on Swedish and German expeditions showed that South Georgia was different and had more affinity with continental crustal rocks. Ferguson prepared the first geological map of South Georgia during the expedition and recognised a range of strongly folded and cleaved sedimentary rocks as the backbone to the island. He discovered various fossils in the slates and limestones of Stromness

Bay. The geological structure, rocks and fossils discovered were described by Ferguson, Tyrrell and Gregory (1914) and by Ferguson (1915), Tyrrell (1915, 1916, and 1918) and Gregory (1914); (Plate 2). Tyrrell (1930) subsequently described the specimens collected from South Georgia during the 1921-22 Shackleton-Rowett Expedition to the South Atlantic and Weddell Sea, although these specimens are now in the collection of the Natural History Museum, London.

Coronation Island, South Orkneys: D. Ferguson 1911-12

Whilst on South Georgia, Ferguson received a gift of ten samples of rocks from Washington Strait from the manager of the Falkland Whaling Company. These slates and phyllites were similar to some rocks of South Georgia, a fact which was also noted by J.H. Harvey Pirie when he examined the rocks back in the geological department of Glasgow University. Harvey Pirie was the geologist on the 1902-04 *Scotia* Scottish National Antarctic Expedition and had previously seen rocks from the South Orkneys.

South Shetlands, Palmer Archipelago & Graham Land: D. Ferguson 1913-14 Second Salvesen Prospecting Expedition

This expedition traversed 3,000 miles of difficult Antarctic seas and collected 131 bags of rock specimens from the N.E. point of King George Island to the S.W. end of Belgica Strait (Plate 3). Ferguson collected 210 specimens in all, which were described by Tyrrell and deposited in the Hunterian, with subsets going to the British Museum (Natural History), the Royal Scottish Museum and the Sedgwick Museum.

Elephant Island, South Shetlands: J.M. Wordie 1914-16 Imperial Trans-Antarctic Expedition

Twenty-six rock specimens collected by J.M. Wordie on Shackleton's *Endurance* expedition have been preserved in the Hunterian collections.

The expedition was mounted in an attempt to make the first crossing of the Antarctic Continent from the Weddell Sea to the Ross Sea, and amongst other scientific objectives, to test whether the Victoria Mountains extended from the Ross Sea to the pole and thence to link up with the Andes of South America. The *Endurance* set sail in 1914 just after the outbreak of the First World War. They progressed as far as South Georgia but had to wait there for a month until the sea-ice retreated. Wordie made extensive collections on South Georgia during the month. As the voyage proceeded (Wordie, 1921):

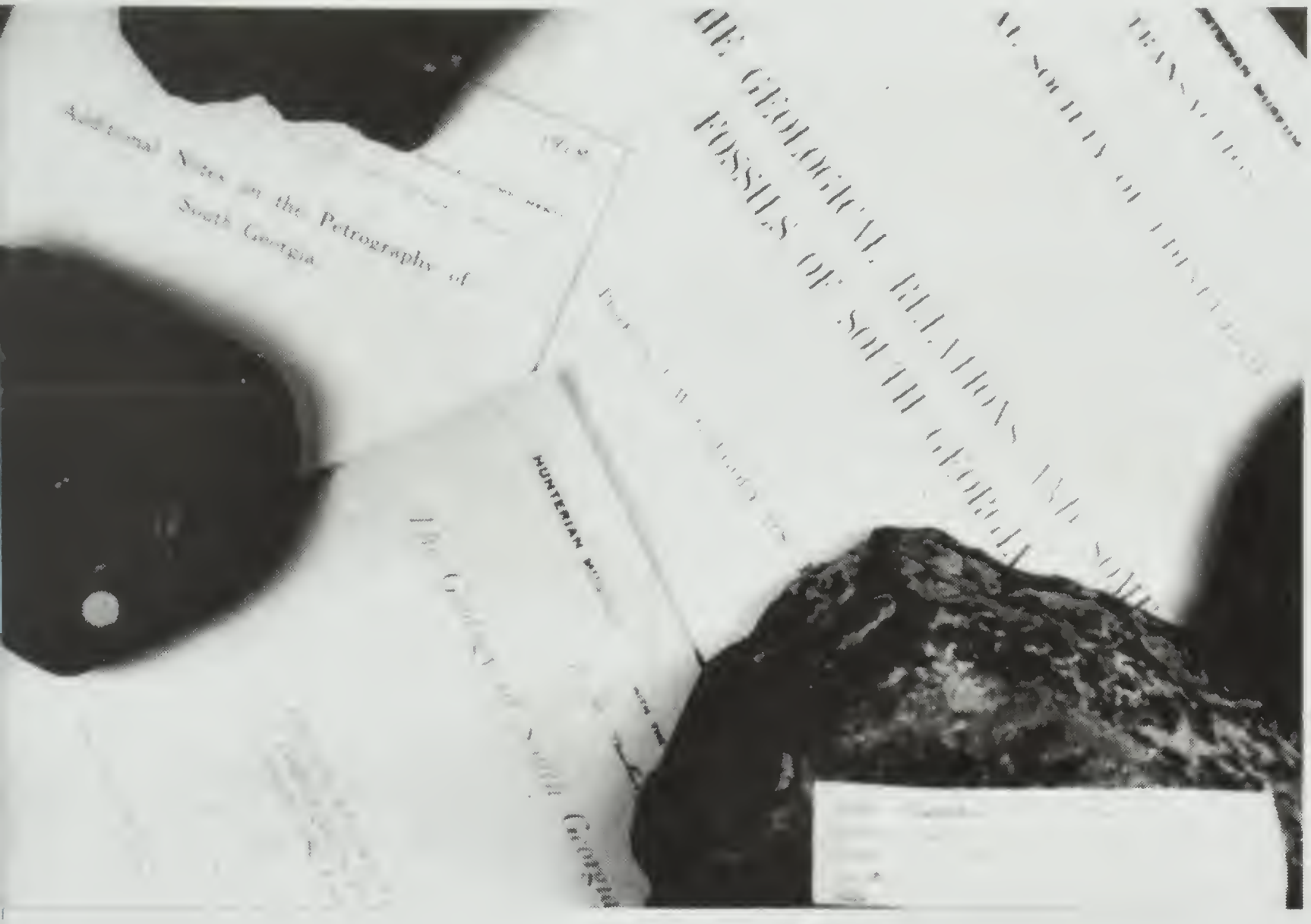


Plate 2

South Georgia collage

Plate 3

S.S. *Hanka*

Second Salvesen Prospecting Expedition

> "...the geologist suppressed all thoughts of rocks, though occasionally they were met with in bottom samples".

and elsewhere:

> "...we pushed the ship against a small banded berg from which W. secured several large lumps of biotite granite. While the *Endurance* was being held slow ahead against the berg a loud crack was heard and the geologist had to scramble aboard at once".

> "...W. engaged in measuring the thickness of young ice, went through to his waist one day just as a killer rose to blow in the adjacent lead. His companions pulled him out hurriedly".

The *Endurance* became trapped in the ice on 20th January and remained so for five months. During this period:

> "...the geologist was making the best of what to him was an unhappy situation, but was not altogether without material. The pebbles found in the penguins were often of considerable interest, and some fragments of rock were brought up from the sea-floor with the sounding lead and the drag net".

Shackleton ordered the abandonment of the vessel on 27th October, and after the *Endurance* was finally crushed with the loss of Wordie's South Georgia collection, the entire crew began their march across the ice dragging the three ships' boats behind them, aiming for Paulet Island some 312 miles away. After very slow progress on foot. the party camped and drifted with an ice floe which started to break up on 8th April 1916. The 28-man party was divided up into the three small boats. On 13th April they were finally in open water and able to sail for Elephant Island, where they landed and made a rough camp. With the Antarctic winter looming, Shackleton set off with five others in an open boat for South Georgia some 800 miles away, leaving Wordie and 21 others to survive as best they could. Wordie, the first geologist on Elephant Island, was able to collect rock samples from Cape Valentine in the N.E. of the island and at Cape Wild, six miles further west, during the 122 days of being marooned.

After an epic voyage and crossing of South Georgia on foot, Shackleton arrived at the Stromness whaling station, and, after several rescue attempts, finally relieved the Elephant Island party and their geological collection on 25th August.

The grey-green phyllites collected by Wordie were described by Tyrrell, and it was clear that they had closer affinity with the rocks of South Georgia and the South Orkneys than with the rocks of the adjacent South Shetlands, Palmer Archipelago and the Danco coast.

Gough Island: Shackleton-Rowett Expedition 1921

In a discussion at the Royal Geographical Society, Commander F.A. Worsley of the *Quest* reported thus (1923):

> "Gough Island we found almost exactly in the old position given by the Admiralty charts and not in the position newly given the Admiralty, which I believe was corrected by the Americans, so we put it back to the old place" (Wild, 1923: 106).

There are 17 specimens in the Hunterian Museum.

Queen Maud Mountains, South Victoria: L.M. Gould 1928-30
First Byrd Expedition

Seven specimens, mainly gneisses and schists, arrived at the Hunterian *via* Rudmose Brown from Gould, who was second in command to Byrd and on the staff of the University of Michigan.

The expedition made the first use of aeroplanes in Antarctica (Byrd, 1930) and a total of 1,600 aerial photographs were taken. Byrd made the first attempt to reach the South Pole by air. The geology of the Queen Maud Mountains was investigated en route to the South Pole by the geological party led by Gould. The geological party also served as an advance rescue team should anything happen to Byrd's plane on the pioneering flight to the South Pole. The geologists used dog sleds to reach the Queen Maud Mountains, which involved a long journey across the ice of the Ross Ice Shelf, well described in Gould's book (1931).

The geological party set out on 13th October 1929. Their first attempt was abandoned because of the cold weather tiring the dogs. A second attempt began on 15th October, with supporting parties laying out a trail of supplies. The geological party finally set out for the Queen Maud Mountains on 4th November. The party of six men had five dog teams, each pulling two sledges. After the planes had been dug out of their snow hangars where they had over-wintered, they made a number of preparatory flights, and during one flight on 18th November, they spotted the geological party struggling along the trail some 200 miles beyond Little America, and dropped off mail and miscellaneous equipment.

On 28th November Gould was able to confirm perfect visibility 100 miles from the Queen Maud Mountains and it was decided that the flight to the pole should be attempted. Byrd flew over the geological party some 325 miles beyond Little America and still 100 miles away from their destination. This first successful flight took place on 29th November 1929.

The geological party arrived at the Liv Glacier on 30th November and spent four weeks exploring the Queen Maud Mountains. On Mount Fridtjof Nansen, Gould (1931) was to make what was for him the climax of his exploration, as he wrote in his 'radiogram' to Commander Byrd:

> "...no symphony I have ever heard, no work of art before which I have stood in awe ever gave me quite the thrill that I had when I reached out after that strenuous climb and picked up a piece of rock to find it sandstone. It was just the rock I had come all the way to the Antarctic to find".

Gould continued in his record (1931: 183-184):

> "This little piece of rock not half as large as the palm of my hand had repaid me for the whole trip; [It] told me beyond question that these mountains were simply gigantic blocks of Earth's crust that had been pushed upward into the air 8,10 or 15 thousand feet".
>
> "Realizing that this was the same kind of sandstone, the same geological formation with the same structure that Farrar, geologist with Scott's first expedition, had found to characterize the mountains far away on the western borders of the Ross Sea, I knew that our Queen Maud mountains were but a continuation and that the whole was the most stupendous faultblock mountain system in all the world".

Heard, Kerguelen and Crozet Islands: D. Mawson 1929-31
British Australian and New Zealand Antarctic Expedition

Sir Douglas Mawson led the BANZARE expedition using the *Discovery* on loan from the British government.

Heard Island, named after the American sea captain who discovered it in 1854, is an active volcano which last erupted in 1987. It was a base for a flourishing seal industry. Some ninety voyages were made by sealers up to 1880 and over 100,000 barrels of elephant seal oil were obtained before the scarcity of seals reduced commercial interest. The German South Polar Expedition produced the first geological description of Heard Island in 1908. The geological samples collected

by Mawson were described by Tyrrell in 1937. Subsequent geochemical studies have revealed the highly potassic nature of the Heard Island rocks, and samples are currently on loan to researchers at the Open University for trace element and isotopic analyses.

South Sandwich Islands: *Discovery II* 1931

The first of the *Discovery II* voyages left England in 1929 to pursue a programme of fisheries/whaling research in the Southern Ocean. The Hunterian Museum houses an impressive collection of *Discovery* material (Table 3), which is not inappropriate since she was built at Port Glasgow.

In 1931 *Discovery* received reports that the pack ice had retreated farther south than in living memory. A decision was made to attempt to survey the South Sandwich Islands, islands so remote that they had only been sighted by ten mariners since Captain Cook, and only seven landings had been made. The South Sandwich Islands form a volcanic island chain some 300 km long. Cook first discovered islands in 1775, but was unsure as to whether there was an island or a continent in the south of the group. Bellingshausen visited the islands in 1820 and Larsen visited the South Sandwich Islands in 1908, landing and collecting geological specimens from five of the islands, although the volcanic fumes almost poisoned him. He remained a sick man for many months afterwards. Shackleton's *Quest* expedition visited the group in 1922.

Discovery reached Zavadovski on 26th February 1930, where it dredged on a bottom of scoria in 152-180 fathoms, and finished surveying the last of the volcanic islands, Leskov, on 18th March. In spite of not having a geologist,

> "Unfortunately we had no geologist with us and in this subject and in physiography I am afraid that our deficiences are apparent" (Kemp, 1932),

the *Discovery II* scientific team was able to collect specimens from a number of sites, making a landing on Thule Island, as well as making various dredge hauls.

The specimens collected eventually found their way to Glasgow, where they were examined by G.W. Tyrrell and identified as typically Andean (calc-alkaline lavas). This observation led Tyrrell to become more supportive of Suess's ideas for a Southern Antillean arc, although Gregory still remained firmly opposed to this view.

Discovery II found herself in the South Sandwich Islands again in 1937, when further dredging took place, but no landings. However, the scientific officer of the

William Scoresby, Mr. G. Rayner, was able to land on Saunders Island for a few hours on 28th November to collect volcanic rocks and beach deposits.

South Shetlands: *Discovery II*, Mackintosh 1934 and Marr 1937

During the third and fourth commissions of the *Discovery II*, 141 rock specimens were collected in the South Shetlands. The majority came from King George Island, with others from Deception, Roberts, Livingston, Nelson and Snow Islands. These samples were described by Tyrrell, who was able to consolidate and extend the knowledge resulting from previous expeditions.

Other *Discovery II* samples were collected from Cape Roquemaurel, Wienke Island and the Marian Darbel Islands. These allowed Tyrrell to confirm previously expressed views that the rocks from West Antarctica were identical to those of the Southern Andes. *Discovery II* also visited the Elephant, Clarence and Gibbs group of islands and dredged for samples in the vicinity of Shag Rocks to the west of South Georgia.

Jan Mayen: Cambridge University Expedition 1921 (*via* J.M. Wordie)
Oxford University Expedition 1947 (*via* A.T.J. Dollar)

Jan Mayen is an Arctic island built of volcanic rocks with only minor intercalations of terrestrial sediments and glacial deposits.

At a time of acute rivalry between Dutch and British whalers, Jan Mayen was discovered and rediscovered a number of times. The island takes its name from Jan Jacobsz May, who is reputed to have landed in 1614 (Wordie, 1926). Robert Fotherby landed in 1615 and remarked how:

> "...all the stones were like unto a Smith's sinders both in colour and forme, the sand is generally mixed with a corne-like amber [i.e. olivine]" (Wordie, 1926: 741).

William Scoresby Jnr. made the earliest geological observations in 1817, and a year later reported what appeared to be an eruption from the 7,470 feet Beerenberg volcano which dominates the island. The volcano was climbed for the first time in 1921 by members of the Cambridge University party led by James Wordie. Having recovered from both his Elephant Island ordeal (during Shackleton's *Endurance* Expedition) and injuries in the First World War, Wordie led the Cambridge party in a geological and glaciological expedition which resulted in the first detailed descriptions of the geology of Jan Mayen (Wordie, 1926) and a

Table 3

Discovery II Geological Collections in the Hunterian Museum

Shag Rocks, West Cumberland Bay, Larsen Harbour, South Georgia
22 igneous rocks
Discovery Expedition

Cape Bowles, Clarence Island
36 igneous and metamorphic rocks
Discovery Expedition (1927 Holtedahl material *via* E.B. Bailey, 1937)

Gibbs Island
14 igneous rocks
Discovery Expedition

Adelaide Island, Graham Land
46 igneous rocks [dredged samples Station 599]
Discovery Expedition

Cape Roquemaurel, Marian Darbel Island
8 igneous rocks (dredged samples)
Discovery Expedition

Signy Sound, South Orkneys
3 schist, gneiss
Discovery Expedition

Cook Islands, South Sandwich Islands
1 olivine basalt
Discovery Expedition

Bristol Island, South Sandwich Islands
4 basalt and gneiss
Discovery Expedition 1930

Cook Island, South Sandwich islands
14 olivine basalt, volcanic ash
Discovery Expedition 1927

Douglas Strait, South Sandwich Islands
1 olivine basalt
Discovery Expedition

Saunders Island, South Sandwich Islands
10 volcanic sand
Discovery Expedition (*via* G. Rayner, 1937)

Thule Island, South Sandwich Islands
15 andesite lavas
Discovery Expedition

Zavadovski Island, South Sandwich Islands
5 basalt, mudstone, volcanic ash
Discovery Expedition

Deception Island, South Shetlands
20 igneous and volcanic rocks
Discovery Expedition (N.A. Mackintosh 1934)

King George Island, South Shetlands
60 igneous rocks
Discovery Expedition (J.W. Marr and N.A. Mackintosh 1937)

Desolation Island, South Shetlands
13 igneous rocks
Discovery Expedition (N.A. Mackintosh 1934)

Nelson Island, South Shetlands
4 igneous rocks
Discovery Expedition (N.A. Mackintosh 1934)

Roberts Island, South Shetlands
16 igneous rocks
Discovery Expedition (N.A. Mackintosh 1934)

Snow Island, South Shetlands
4 igneous rocks (3 *in situ*, 1 pebble]
Discovery Expedition (N.A. Mackintosh 1934) 37?

Port Lockroy, Wiencke Island
4 tonalite
Discovery Expedition (N.A. Mackintosh 1935)

petrological account by Tyrrell (1926). The rock specimens are now in the Hunterian Museum collection.

Since 1921 seven British expeditions have visited Jan Mayen, and Dr. A.T.J. Dollar was principal geologist on most of these. In 1947, at the suggestion of Wordie and Tyrrell, Dollar, a lecturer at the University of Glasgow, joined an Oxford University Expedition to Jan Mayen and the Greenland Sea. His junior colleague at the University of Glasgow, D.M. Boyd, joined him as field assistant: 254 specimens resulted. Dollar returned to Jan Mayen in 1950 with another Oxford University expedition, and then again in 1959 with the first of two University of London expeditions. The second of these expeditions in 1961 ended in disaster when six of the party were killed in a boating accident. The accumulated collection of rocks from these expeditions resided in Birkbeck College until a few years ago when, following completion of a Ph.D. thesis on the geochemistry of Jan Mayen, the entire collection and substantial archive was offered to the Hunterian Museum for safe-keeping.

WORK OF EARLY GEOLOGISTS

Work of Early Surgeon Naturalists

1829 W.H.B. Webster in H.M.S. *Chanticleer* made notes on the geology of Deception Island as well as the pendulum measurements in what came to be known as Pendulum Cove.

1829-31 James Eights on U.S. Fanning expedition to the South Shetlands - found fossil wood in a conglomerate beneath the basalt of Deception Island.

Geologists at Work

Dundee Antarctic Expedition, *Balaena* 1892-93

W.S. Bruce was naturalist/doctor on this commercially-funded voyage to look for whales. Four ships left Dundee, the *Balaena, Active, Diana* and *Polar Star*. The expedition was strictly commercial, looking for whales with a fortune in their mouths:

> "You will find in the *Ladies Pictorial* plenty of pictures of the people who keep up the price, or you can see them half alive in the streets - willowy things with their blood squeezed into their heads" (Murdoch, 1894).

[the whalebone in the jaws of one whale
was worth two or three thousand pounds]

"In the Falklands the doctor and I made our escape and went in pursuit of science. Bruce dropped out next to chip off pieces of the grey quartzite that crops out through the peat" (Murdoch, 1894).

"...it was the ensemble of flowing mackintosh, vasculum, geological hammer, Jaeger snow cap and shooting boots that suggested the present medicine man of scientific tastes and the Antarctic Pytheas of time to come" (Murdoch, 1894).

"...we bewailed the utter commercialism of the expedition. Is it not a hideous marvel that Dundonians should show such splendid enterprise as to send four ships out here for whales and at the same time show total disregard for the scientific possibilities of such a cruise...if we lay hold of glacier rocks or bird's skins we raise a whirlwind of objections and an endless reiteration of the painfully evident truth that 'this is no a scientuffic expedeetion'" (Murdoch, 1894).

"...we have been close enough to the land to enable us to distinguish the colouring and form of the rocks...it is a marvel that no scientific expedition has been sent down here since the days of Ross....It is almost unbearable to see the land so close and yet have no means to land on it. We feel tempted to jump overboard and swim. All our boats hang idle on the davits, yet we are not allowed one to land with. Captain Larsen of the *Jason* has landed and tells us he found beds of fossils on the beach, shells and tree trunks" (Murdoch, 1894).

"The *Balaena* was never within less than 6 miles of land" (Bruce, 1896).

"A few rocks secured from a piece of ice and from the stomachs of penguins..." (Bruce, 1896).

"I regret that I was unable to bring more rock specimens, several of the largest having been heaved overboard by some unknown member of the crew. I believe these latter were also olivine" [not the lightest of material!] (Bruce, 1896).

"...it seems incredible that gentle, loving law-abiding Bruce and the writer if possible more so, could have lain swinging in our hammocks...watching the blue lace-lined seas slipping past and planning how to tip the old man overboard or slit his throat" (Murdoch, 1923).

In a discussion at the Royal Geographical Society in 1893, following John Murray's paper on the renewal of Antarctic exploration (Murray, 1894a), the President called on Bruce as "a young volunteer who has actually been to these

Antarctic regions a very short time ago" to give "a short account of his experiences". In Bruce's reply we can sense the depth of his disappointment:

> "Our ship....was very efficiently equipped with scientific instruments, although the expedition in the main was commercial; but the results of the scientific observations, I must confess, were most disappointing; not even the smallest amount of work I had hoped for was accomplished. Nevertheless, I have not regretted the experience, and I think the expedition has revived, in a sense, the feeling that there should be another great Antarctic expedition, and I agree thoroughly with Dr. Murray and the other speakers who said that this expedition should be of a national character".
>
> W.S. Bruce; in Murray (1894a: 35).

It took Bruce nine years to realise his aspirations, and in the meantime the National Antarctic Expedition under Scott was set up.

Belgian Antarctic Expedition 1897-99

Arctowski accompanied the expedition as geologist and glaciologist. His is the classic description of what Adie (1964) has termed the "hit-and-run" approach.

> "The commandant showed himself very obliging, but with a little good will we could have landed in many other places and collected much more geological material than we did. For the eighteenth landing he conducted me himself but for ten minutes only. A few strokes of the oars brought us to the beach amid cries of "Hurry up Arctowski"! I gave the hammer to Tellefsen with orders to chip here and there down by the shore while I hurriedly climbed the moraine picking up specimens as I ran, took the direction with my compass, glanced to the left and right and hurried down again full speed to get a look at the rock *in situ*; meanwhile Cook had taken a photograph of the place from the ship - and that is the way that geological surveys have to be carried out in the Antarctic".

Scottish National Antarctic Expedition, Voyage of the *Scotia* 1902-04

This highly successful yet under-acknowledged expedition was led by Bruce, with J.H. Harvey Pirie as expedition geologist, bacteriologist and medical officer. Harvey Pirie gained valuable experience of the difficulties of collecting samples when at St. Paul's Rocks:

> "...as geologist I was given the honour of first attempt at landing: the whale boat was backed in as close as was possisble and I jumped - but just a fraction of a second too late: the boat had begun to fall with the swell, the take off was bad and instead of getting a firm footing, I fell down into the

> water literally swarming with sharks...I was hauled in by the scruff of the neck...but the chief considered it inadvisable to risk another attempt" (Three of the Staff, 1906).

Scotia overwintered in the South Orkneys where Pirie:

> "...had many difficulties to contend with in geology, but he triumphed over all in his discovery of fossils in the rocks near Cape Dundas" (Adie, 1964).

The graptolites and arthropods discovered on Graptolite Island were sufficient to assign an Ordovician age to the rocks of South Orkney (Pirie, 1905). Adie (1964: 125) had particular praise for Pirie:

> "His numerous structural and stratigraphical observations were extremely acute".

A Lost Continent

> "The presence of isolated islands such as the South Orkneys and South Georgia, composed entirely of sedimentary rocks and surrounded by deep waters proves a former much greater extension of land in this area of the Earth's surface. These rocks were originally laid down under water; subsequently Earth movements on a large scale must have raised up a great part of the South Atlantic into dry land, - quite possibly continuous with what is now South America and South Africa, - the same movements bending, folding and fracturing the rocks into much their present condition. Still later changes have again depressed most of the area under the ocean leaving these tiny islands as the remains of a lost continent. This story holds good of the rocks whatever their age but the finding of fossils enables us to take another step in tracing back the history of this corner of the globe. Rocks of a similar age occur on both sides in the province of Buenos Aires. The ridging up of the Andean Chain - a long wrinkle in the Earth's surface formed as it grew old and cooled - brought these beds to light from the bottom of the sea: the probability is that the same ridge which we see bending eastwards in Southern Patagonia and Tierra del Fuego once continued still further far east and the rocks of the South Orkneys lay on one flank of this sub Andean chain. How it became cut across by what is now called the Drake Strait is for future exploration to decide but probably much of the story is for ever hidden from us - lost beneath the waves of the stormy Cape Horn Seas" (Three of the Staff, 1906).

During the second Antarctic season *Scotia* travelled to discover Coats Land on the Antarctic mainland:

> "...that the land is of a continental character is shown by the boulders brought up in the dredgings taken in the vicinity - boulders which have been picked up by the ice-sheet from the underlying rock and deposited on the floor of the ocean by the melting of the bergs. Amongst others, granites, schist, gneiss, quartzite, sandstone, slate and limestone were found, all rocks characteristic of an old continental land surface" (Three of the Staff, 1906).

Scotia demonstrated that the Ross 'deep' was in fact considerably less than 4,000 fathoms (2,660 m), and the expedition was thus able to demonstrate a southerly extension of the Mid-Atlantic Ridge.

Geology in the field: Scott *vs* Amundsen Expeditions

Reviewing the problems of Antarctic geology which remained in 1928, Priestley and Tilley meted out some swingeing criticism, after praising Amundsen for his organizational genius:

> "One most serious shortcoming of the great journey was his failure to spend easily spared time in making at least a general survey of the geology of that most interesting portion of Antarctica it was his good fortune and privilege to discover and traverse".
>
> "There is no more important object lesson to the geological party of the future than that afforded by the contrast between the geological harvest of the Scott and the Amundsen southern parties".

Scott Expedition

> "In a cairn within a few miles of their last resting place their comrades later found a priceless bag of specimens, collected, many of them, after the direness of the emergency must have been realized. By their side lay the notebooks containing the detailed notes, lacking which the specimens would have been deprived of half their value" (Priestley and Tilley, 1928).

Amundsen Expedition

> "On the other hand, a few hundred miles away and two months earlier, another party, secure in the attainment of their dominant ideal, safe beyond any reasonable doubt from failure, made a hurried traverse of a region more interesting because less well known, returning to their base unwearied and ahead of scheduled time, bearing with them a few fragments of rock from one or two of the many rock exposures on whose surfaces their eyes had been the first to rest" (Priestley and Tilley, 1928).

CHANGING GEOLOGICAL PERSPECTIVES

Origin of Ocean Basins

St. Paul's Rocks - or Searching for *Atlantis* with a Microscope

A paper entitled 'A search for *Atlantis* with the microscope' was published by Archibald Geikie in *Nature* in November 1882. Another paper entitled 'The microscopic evidence of a lost continent' was published in the American journal *Science* the following year.

These two papers clearly illustrate not only the developing petrological knowledge of the age but also the contemporary thinking about the origin of islands within ocean basins as the products of volcanism or as the remnants of submerged continents.

St. Paul's Rocks are a remote group of barren islets in the Atlantic just north of the equator (Figure 2). They were discovered by accident in 1511 when one of six ships sailing east from Brazil struck the Rocks at night. The ship, the *Sao Pedro*, was lost but gave its name to the islets. Abbreviated to *Sam Po* when first charted in 1519 it became mistakenly named Sao Paulo by later cartographers, like Mercator in 1538. Since then the two names have tended to be used interchangeably (Edwards, 1985).

They were visited by Charles Darwin in 1832 during the voyage of the *Beagle*, and it was Darwin (1839b) who first suggested that the rocks were unique within the ocean basins in having a non-volcanic origin. McCormick, the naturalist with James Clark Ross on the *Erebus,* collected samples in 1839 en route to Antarctica. He disagreed with Darwin and believed the rocks to be volcanic (McCormick, 1847). This set the pattern for a debate which was set to continue until the middle of the twentieth century.

H.M.S. *Challenger* spent two days at the rocks in 1873, and Darwin's comments prompted John Murray to invite the eminent Belgian petrologist Abbé A.F. Renard to describe the resulting rock specimens (Plate 4) (Renard, 1880).

In his principal work on the rocks published in 1882, Renard debated a volcanic origin for the rocks but finally came down on the side of their being better grouped with crystalline schists, inferring a continental origin for the rocks and implying that the plutonic rocks were remnants of an extensive central Atlantic land mass (a

Plate 4

St. Paul's Rocks specimens

lost continent or 'Atlantis'). This led to the papers by Geikie (1882) and Wadsworth (1883), neither of whom could accept Renard's conclusions.

In the absence of any evidence of contact relationships with adjacent rocks, the matter lay unresolved. Meanwhile, other expeditions visited the islands, including *Scotia* in 1902, the second German South Polar Expedition in 1911, the Shackleton-Rowett expedition in 1921, *Meteor* in 1925, and *Discovery II* a few years later. (Shackleton's visit brought his explorations full circle, since he first visited St. Paul's Rocks as a 16 year-old, and then on the way south on his final and fatal expedition).

Darwin's and Washington's specimens were studied by Washington (1930) and Tilley (1947) and the metamorphosed plutonic nature of St. Paul's Rocks came to light, although the final unravelling of their true nature as a piece of the Upper Mantle had to await detailed American studies in the 1970s following the development of a unified plate-tectonic theory.

Oceans, Continental Drift and Plate Tectonics

We have already alluded to the importance attached to early discoveries of continental-type rocks on some of the islands, like the Falklands and South Georgia, and it is fascinating to read the discussions in the early part of the 20th century where geologists were grappling with the evidence of the rocks in the absence of a satisfactory driving force. For some, the evidence of comparable stratigraphic sequences in widely separate localities outweighed the difficulties of finding a viable mechanism, as at a discussion of Wegener's hypothesis in 1923, where Dr. Evans remarked:

> "Dr. Baker, who has spent two years in the Falkland Islands on behalf of the British government in investigating their geology, has shown that the succession is, bed after bed, a repetition of that in the part of South Africa which is in the greatest proximity to the Falkland Islands. I find it more difficult to believe that there were exactly similar conditions spreading over the thousands of miles between South Africa and the Falkland Islands than that they have drifted apart" (Lake, 1923: 192).

Other leading geologists, Gregory in particular, were struck more by the enormous depths sounded off many of the islands; the great **vertical** subsidence required seeming to preclude the kind of **lateral** movements demanded by the continental drift theory, which in the 1920s were thought to be very fast. Wegener himself considered that Greenland did not split from Europe until the Middle

Pleistocene, requiring a westward drift of 32 m/yr - about one thousand times faster than rates are currently thought to be.

Gregory synthesized much of the data for his presidential address to the Geological Society of London in 1929 on *The Geological History of the Atlantic Ocean*. His work has often been dismissed because of his long adherence to the theory of the permanence of ocean basins. A closer look, however, shows that in several important respects he was spot on, and it is important that we do not confuse permanence with drift. His writing is typically trenchant:

> "If isostasy be so stated that it is inconsistent with the subsidence of the ocean-floors, so much the worse for that kind of isostasy" (Gregory, 1929).

His Permo-Triassic palaeogeographic reconstruction is revealing: Gondwanaland includes the Falklands and South Georgia but Antarctica is oceanic. This contrasts with the view of Ferguson (1921), expressed some eight years earlier:

> "That in the time of Gondwanaland, Antarctica was united to South America, South Africa and Australia is not a visionary idea. Remains of this ancient land still exist in South Georgia, the South Sandwich Islands, Bouvet, Marian, Crozet, Kerguelen, MacDonald and Macquarie Islands - the long chain of islands that lies along the Southern Ocean concentric with the coast of Antarctica. This land probably connected Antarctica with Gondwanaland in South America, South Africa and Australia. Great subsidences have sunk most of the original area to great depths below the sea, and long-continued erosion has reduced the rest to a chain of islands".

Gregory's final paragraph supplies the proof that he did **not** in fact actually subscribe to the permanence of oceans. Indeed, it is broadly consonant with what we now know from the results of the Deep Sea Drilling Programme (DSDP) in the era of sea-floor spreading (e.g. Vine, 1966) although we would now bring forward the onset:

> "...there was no ocean entitled to rank as the Atlantic during the Palaeozoic and Mesozoic Eras".
>
> "...its formation began at the end of the Cretaceous".

This later substantiation of his ideas would probably have pleased Gregory greatly, for, as he revealed in a letter to Boswell, his obituarist, he was:

"...afflicted by two ingrained habits of mind".

The first of these was an interest in what was likely to be the thought of the future rather than in current opinion. Thus in one sense the recent demonstration that most of the giant domes in the N.E. Atlantic are of Oligocene age (Swiecicki *et al.*, 1998) would not have surprised Gregory, for he believed that the Atlantic:

> "...was effected mainly after the widespread mountain-building movements of the Oligocene Period".

But in actual fact these domes were produced by a change in the direction of spreading at this time, and were thus **caused** by the mobility of the ocean floor. Furthermore, much Atlantic opening occurred prior to the Oligocene.

It is an interesting reflection that many proponents of continental mobility spent some of their formative years in the polar regions. Not only Wegener, who died in the Arctic in 1930, but also later scientists like Drummond Matthews (1959), who, with Fred Vine in 1963, made the crucial deduction about the significance of the symmetry of the magnetic stripes about the Mid-Atlantic Ridge (see review by Vine, 1966). We should note, however, that even during those heady days of the interpretation of remotely obtained ship-board data, the leading proponents never forgot the evidence of the oceanic islands themselves (Wilson, 1963).

In the current era of plate tectonics it is fascinating to return to the South Sandwich Islands, source of much material from early expeditions now in the Hunterian (Table 1). Compare the location map (Figure 1) with the plate map (Figure 5) and notice how small the Sandwich Plate (stippled) is, with the Islands lying above a zone of convergence with the South American Plate.

Deep-Sea Sediments, Palaeoceanography and Global Warming

Gregory gave considerable weight to the interpretation of successive faunal distributions through time, but he attributed too great a significance to physical barriers rather than to the isolating effects of contrasted ocean currents in a variably glaciated and widening Atlantic - a major change of perspective which has been brought into sharp focus recently but which had actually started well before he gave his address.

H.M.S. *Challenger* (1873) laid the foundation for the study of palaeoceanography (Figure 3), but it was in 1901 on the German South Polar Expedition that Philippi, who had previously worked with Murray, made an

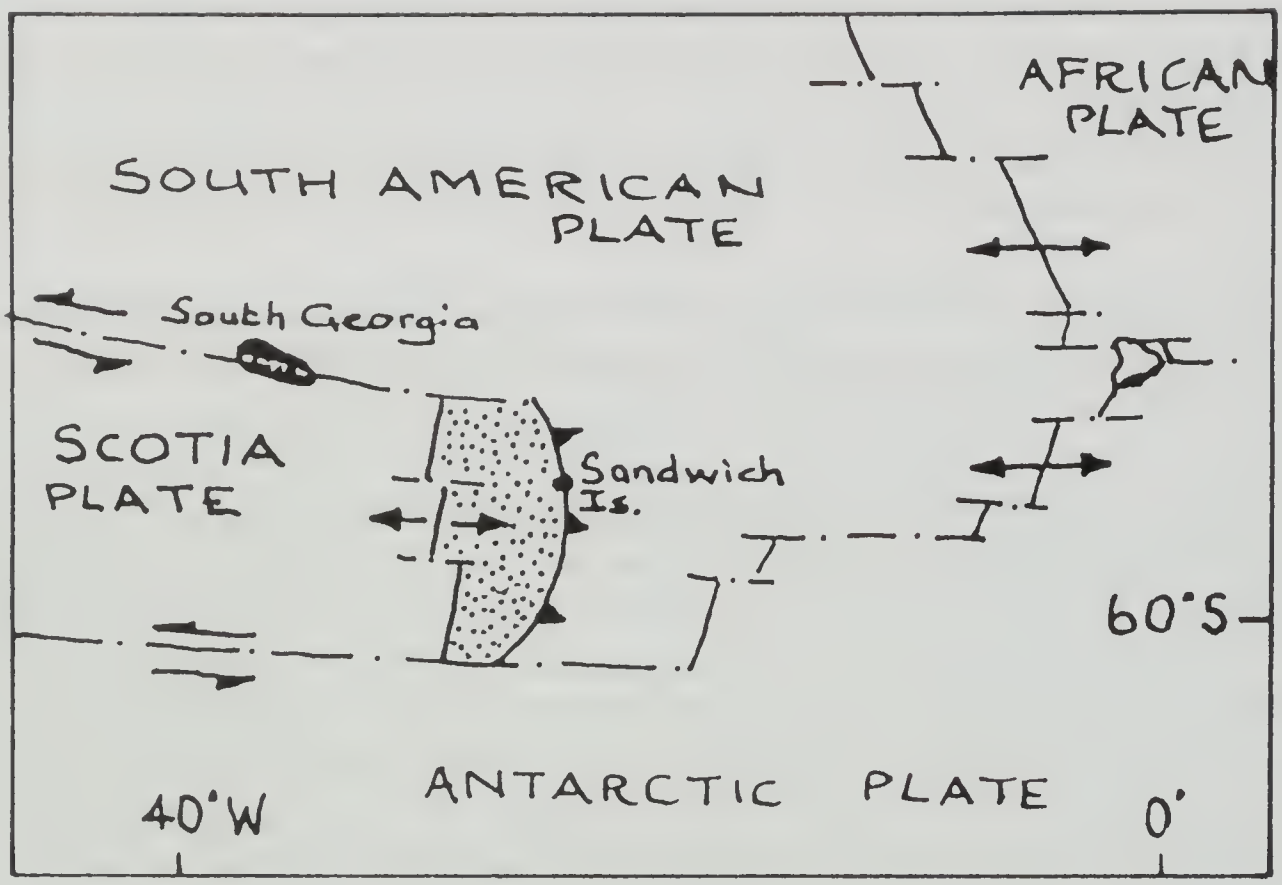


Figure 5

Plate-tectonic configuration

important step forward. His studies of stratification of deep-sea sediments found diatom ooze beneath *Globigerina* ooze, which suggested a retreat of Antarctic influence. Since that time, refinements in piston coring (Wise, 1981) and in isotopic/palaeotemperature study of foraminifera from deep-sea cores, have brought about spectacular advances in our understanding of the impact of Antarctic glaciations through time. The biostratigraphy of all 18 DSDP holes in the Southern Ocean has recently been reassessed (Ramsay and Baldauf, 1999). First indications of East Antarctic ice may now date back to the Palaeocene, 59 million years ago (Abreu and Anderson, 1998), whereas Arctic ice sheets first formed a mere six million years ago.

During the Tertiary as a whole, warm and cold events were felt globally. Antarctic influence can be detected in the Tertiary rocks cored from North Sea oilfields, where widely correlative organic-rich mudstone seals are associated with warming and high sea-levels. In contrast, sharp intensification of oceanic circulation consequent upon Antarctic cooling has resulted in low sea-levels, seismic sequence boundaries and frequently the deposition of deep-water reservoir sands.

The impact of these palaeoceanographic events will be considerable for biostratigraphic correlation. This is because of the strong control exerted on microfauna by water temperature. Fossils previously thought to be part of an evolving lineage and therefore reliable as time markers are now considered far more likely to be temperature controlled. They may therefore be unreliable for correlation between different basins because individual basins will have come under differing degrees of influence from Antarctic-derived bottom water, depending upon their palaeogeographic relationship with a widening and deepening Atlantic.

Thus work begun on Antarctic expeditions by the likes of Murray, continued in the deep ocean by Shackleton's descendants, has ended with global ramifications. It is now an established fact that Global Warming has occurred on a number of occasions.

Oceanic Rocks and The Search for Oil

Recent years have seen an active campaign of drilling for hydrocarbons on the Falklands Plateau, for example, and we are about to witness extensive exploration around the Faroes. Oil companies have despatched their petroleum geologists into the field, accompanied by academic experts. A vital part of this work, in a new basin especially, is to establish whether a source rock from which oil could have been generated, is present. The geologists will also be on the lookout for different

types of reservoir rocks, and will be collecting fossils in order to date seismic reflectors offshore.

In short, they will be treading a well-worn path pioneered by the explorers whose activities we have outlined earlier and whose collections now reside in our museums. Examination of museum material should thus be a useful part of the work necessary in amassing pre-drilling data, but care is necessary.

To continue with our Falkland example, there are specimens of torbanite, a good source rock for oil, in the collections of the Hunterian Museum. They were washed up on the shores of Weddell Island in West Falkland, and one possible interpretation might be that they denote an *in situ* outcrop offshore. However, also in the Hunterian Museum there is correspondence indicating that the specimens were probably washed overboard from steamers carrying the torbanite from New South Wales to Britain via Cape Horn (Ferguson, 1922).

In 1997 the Falklands featured prominently in a discussion at the Geological Society of London on the *Oil and Gas Potential of the South Atlantic*, even though most of the papers dealt with the ocean margins (Cameron, Bate, Clure and Smith, 1999). Phil Richards of B.G.S. Edinburgh pointed out that DSDP provided evidence of buried Upper Jurassic source rocks, not present at outcrop (of the same age as those in the North Sea).

It seems a far cry from the fixist theory of Gregory (1929) to the detailed discussions now taking place on how much rotation the 'Falkland Islands microplate' has undergone during its split from a position off Cape Agulhas in South Africa. Figure 6 shows the latest attempt at a reconstruction of Gondwanaland 1,100 million years ago (Jacobs *et al.*, 1999). In this context it is wonderful to appreciate that specimen No. 955 in the Hunterian Museum is labelled 'tillite' and, moreover, ascribed to the Dwyka horizon - the type area being in South Africa, even though the specimen was collected from Hill Cove in West Falkland. And this in 1916!

A further Geological Society of London conference was organized in 1999 by David Macdonald (a Glasgow geology graduate from 1975 and at that time head of the Cambridge Arctic Shelf Programme) specifically on the *Role of Geological Fieldwork in Hydrocarbon Exploration and Production*. In it, David Worsley has shown how significant the rarely seen and even more rarely visited Arctic island of Bjørnøya is for developing new exploration ideas for the Barents Shelf. New field information on the late Palaeozoic evolution of the island provides the clue to reservoir development, by relating episodes of sea-level fall to the creation of cavernous porosity within the carbonate rocks (Worsley and Gjelberg, 1980).

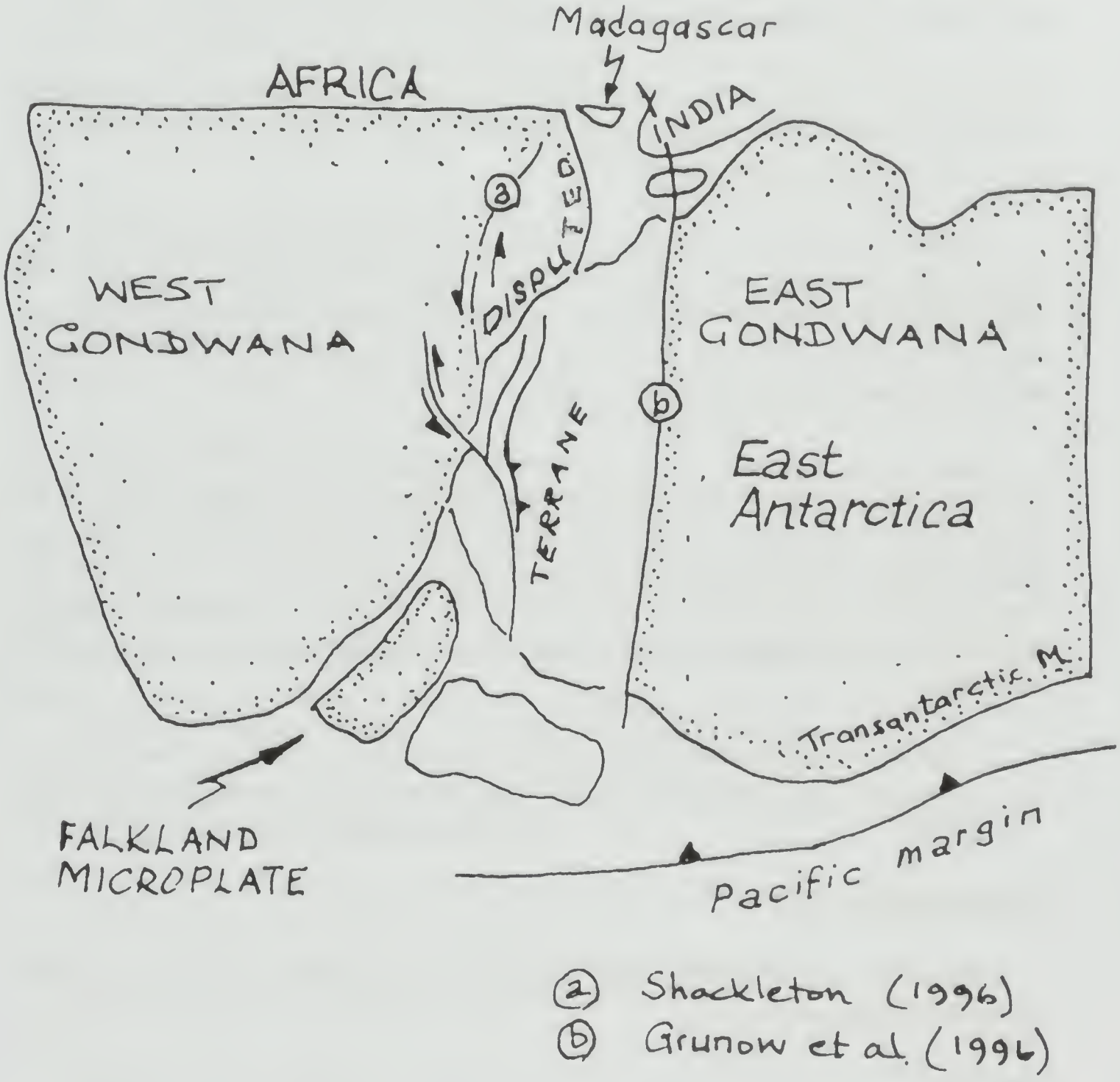


Figure 6

Gondwanaland

Conclusions

The wheel has come full circle. Almost 200 years ago expeditions were despatched to the Southern Ocean in the quest for economic resources. Today we are still searching, but with a heightened awareness of the sublety of the interweavings of Nature. Now more than ever we need the historical benchmarks of definitive surveys and authenticated specimens against which to compute change and Man's possible influence upon it.

Change is a natural phenomenon. This is one of the key lessons of Geology, yet how would we be in a position to evaluate it without the platform created by the early explorers? From their sacrificially collected specimens have emerged the very studies that now turn out to be central to our understanding of climatic change, natural resources and the global economy.

It may seem a far cry from the propellor-head at his work-station to the museum cabinet, but, as we hope we have demonstrated, the only proof of an occurrence is a specimen. Without those specimens - difficult rocks from difficult places; without the wherewithal for their study - Museums, Core Stores and Oceanographic Laboratories; and most of all, without a long-term strategic appreciation of their value - there would be no basis upon which to evaluate our own future.

> "It is our object as a scientific society to promote everything that increases knowledge, and the interest which men must feel in the phenomena of our globe". Duke of Argyll, in Murray (1894a: 31).

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